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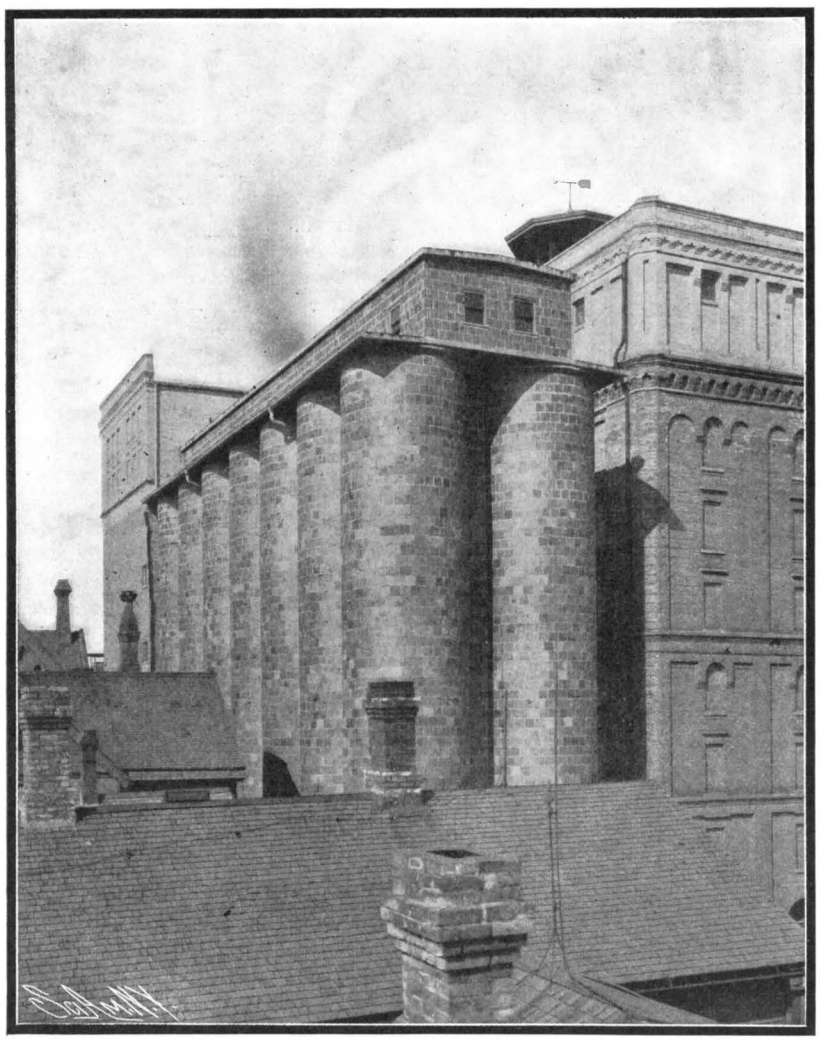

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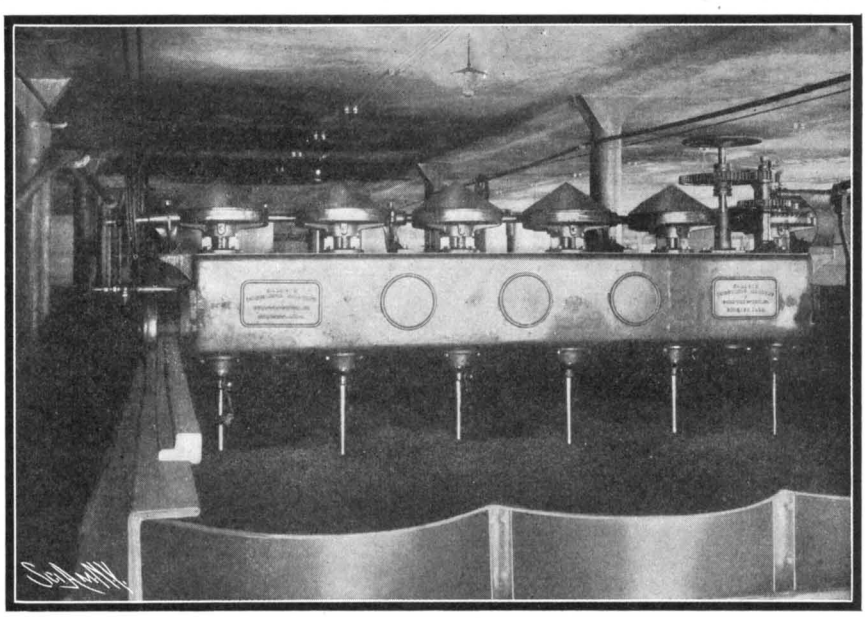

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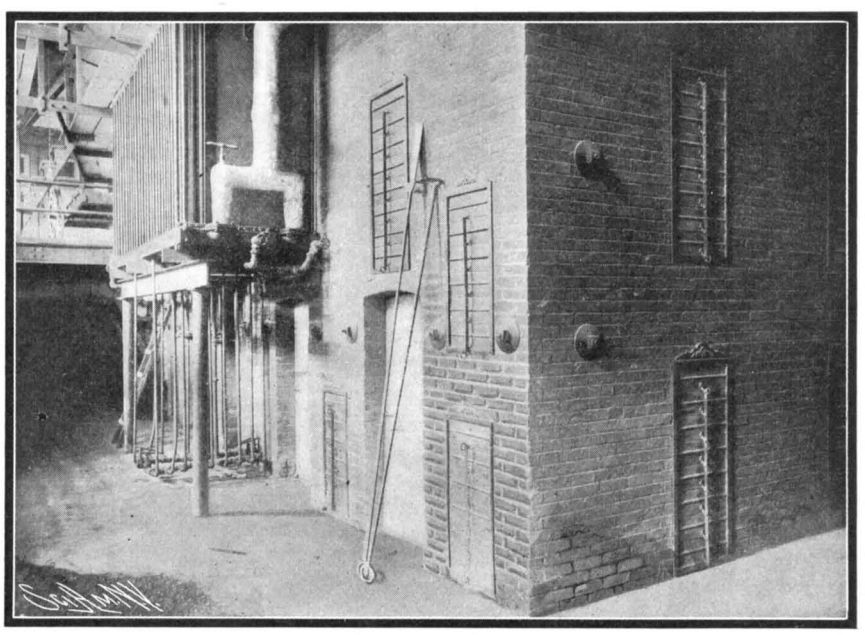

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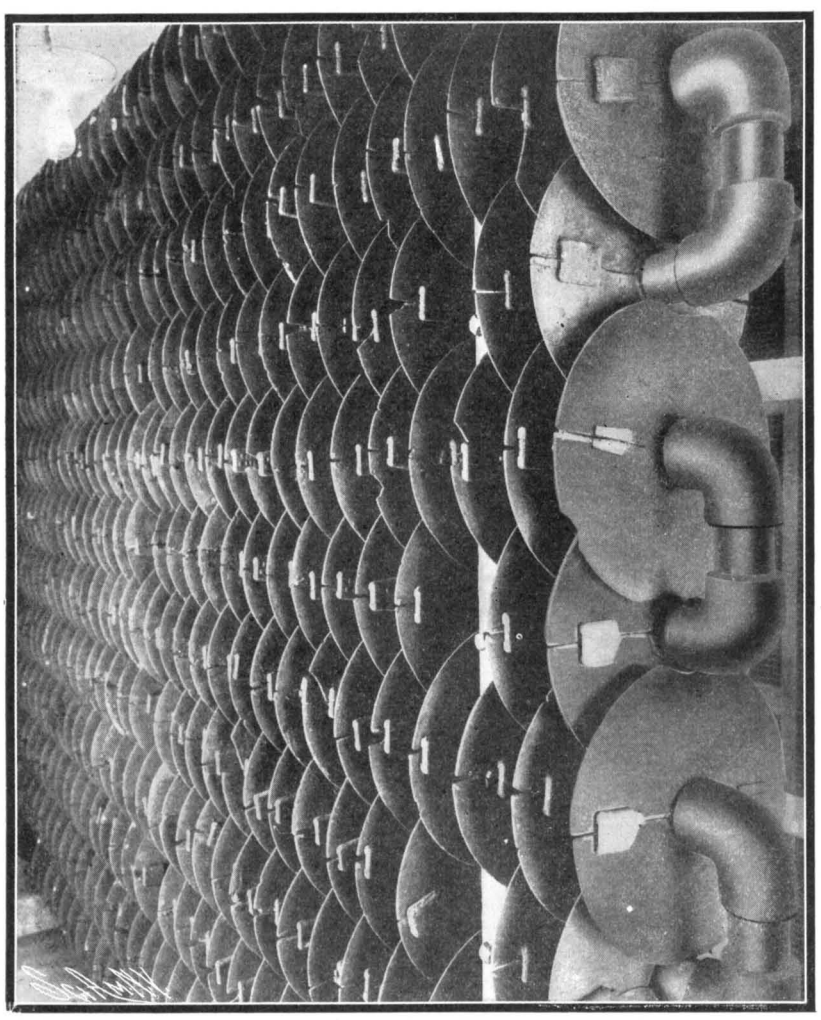

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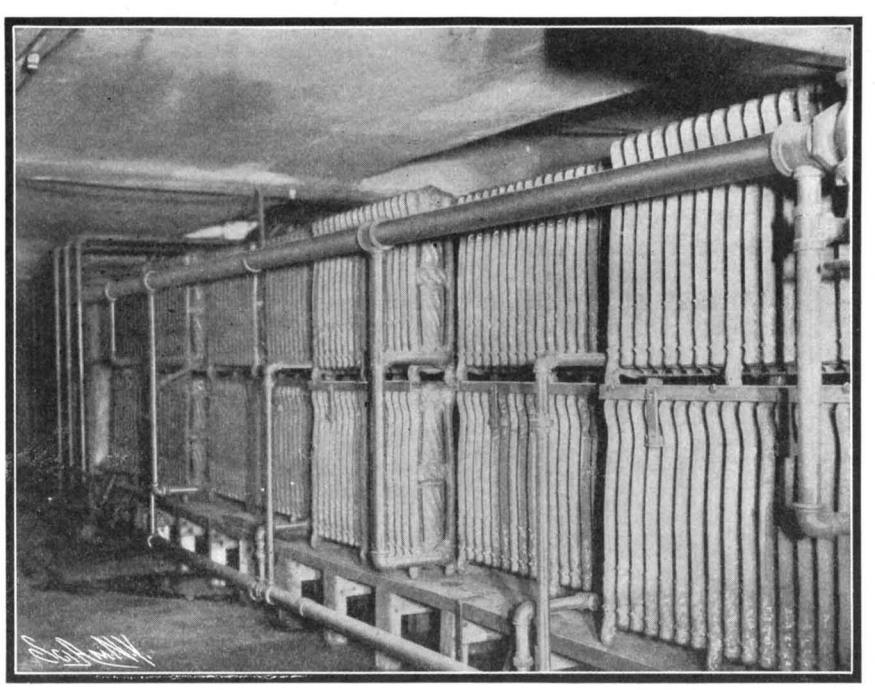

Heating the Air.

MALTING BARLEY BY THE PNEUMATIC SYSTEM AND THE CREATION OF AN ARTIFICIAL ATMOSPHERE.

MALTING CONDUCTED ON SCIENTIFIC PRINCIPLES.—[See page 292.]

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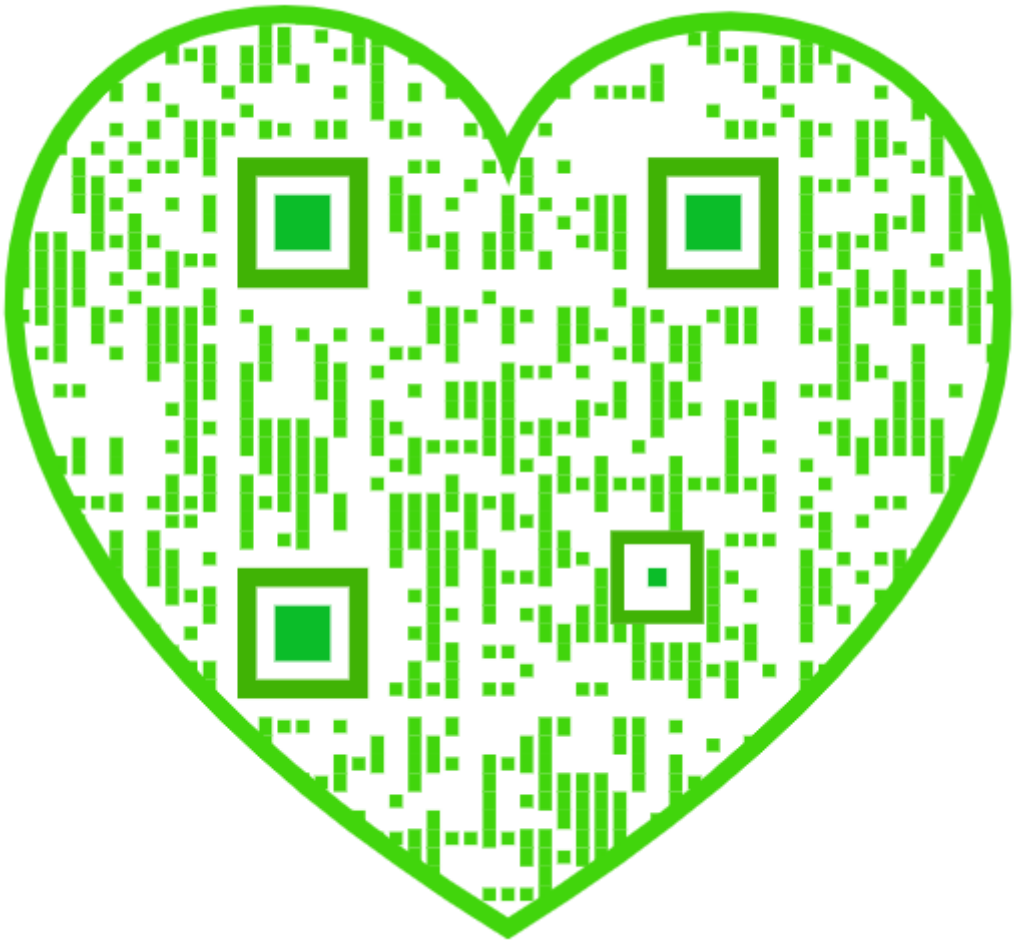

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NEW YORK, SATURDAY, APRIL 9, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THAT FIRE PERIL AGAIN.

Once more we have received clear warning of the fire peril which confronts the congested business centers of our large cities. This time it was in the Adams Express building, one of several very old and inflammable structures, that stand on the west side of lower Broadway, just below Trinity Church. The conditions, as far as the buildings were concerned, were ideal for a great conflagration, for they were quite open to the sweep of a prevailing westerly wind which, had it been stronger, might well have carried the fire across Broadway into the great mass of tall buildings in the Wall Street district opposite. The situation would have been decidedly critical under ordinary circumstances, for the fire swept rapidly through the Adams Express building, and was raging fiercely very soon after the blaze started; but what made the fire strongly suggestive of another Baltimore disaster, was the fact that for the first half-hour of the efforts of the Fire Department, although the engines were driving under a full head of steam, they had difficulty in raising even small streams of water to the third and fourth stories of the burning building. In other words, the water supply in the mains was for some reason or other very low, and quite inadequate to keep the fire engines going at full capacity. This was noticeable in the case of the first of the water towers to be started in Broadway; for, although three lines of hose are usually sufficient, in the present case it took six lines to throw a stream of the proper volume. The dangers from fire to which the city is exposed are fully appreciated by our very efficient Fire Department, and a hint of this was given in the fact that although only one five-story building was immediately involved, the "double nine" call was sent out, and engines hurried to the fire from far up town. The early concentration of such a powerful force at a fire of really moderate proportions, suggests that the Baltimore disaster has rendered the Fire Department doubly apprehensive of the ever-present danger of a widespread conflagration; and it is gratifying to learn, as we go to press, that the Board of Estimate has voted an appropriation of $5,425,400 for the installation of the high-pressure auxiliary water supply, that was recommended by the engineers of the Department of Water Supply, Gas, and Electricity.

THE BLOCKING OF THE PORT ARTHUR ENTRANCE.

The blocking of the entrance to Port Arthur would have had more significance before the invention of high explosives than it can possibly have to-day. If it is successfully done, it will, of course, greatly simplify the naval situation as far as Japan is concerned—for the present, at least; for it will mean the detention of the Russian fleet within the harbor for a considerable period, leaving the Japanese fleet free to devote its attention to the armored cruiser squadron at Vladivostock; the work of the transports in transporting the troops and supplies of the Mikado's army being rendered for the time being perfectly secure.

It is a mistake to suppose, however, that the sinking of a line of merchant ships across the harbor entrance would "bottle up" the Russian fleet for good. Modern high explosives, properly placed, would cut the sunken Japanese ships to ribbons, and it would be possible to dredge out and remove the wrecks, piecemeal, until the channel was clear. Of course, these operations would not be allowed to go on undisturbed by the enemy, who would bend every effort by long-range bombardment of the wrecking crews to hinder, if not altogether to prevent, their operations. The bottling up of Port Arthur is without doubt the most important and urgent step that the Japanese can take, for it is absolutely necessary that Makaroff's fleet be captured or destroyed, or at least rendered inoperative, before the arrival of the relieving force from Europe.

The destruction or capture of this fleet, so long as it remains under the guns of Port Arthur and behind protecting mines, is out of the question; but if the harbor entrance can be sealed, and kept so, Admiral Togo can await the approach of the Baltic fleet with composure. We may look for frequent repetitions of such daring attempts as were recently made to sink heavily-laden merchant steamers across the narrow channel. Not merely does the fate of the Japanese navy ultimately depend upon this successful bottling up, but also the fate of the army of invasion itself. If, during the coming summer, the Baltic and Far Eastern fleets should be able to unite; and, unless the Russian officers and seamen are altogether incapable, Japan would have to face the likelihood of defeat by overwhelming numbers. With Russia in command of the seas, the Japanese army would be cut off from its base of supplies, and the question of capitulation to the advancing and steadily-growing army of the Czar would ultimately have to be faced. Never was the advantage of the command of the sea so strikingly illustrated as here; and the struggle of Japan to maintain her present advantage promises to form one of the most fascinating chapters in the history of naval warfare.

DEPARTURE OF THE PANAMA CANAL COMMISSION.

The recent sailing of the Panama Canal Commission for the Isthmus on their first visit of inspection, coupled with the announcement from Paris that the suit of the Republic of Colombia against the Panama Canal Company has failed, must bring home to the people of the United States the conviction that the long-deferred construction of the canal across the Isthmus is at last about to commence. The commission, as appointed by the President, consists of Rear Admiral John G. Walker, William Barclay Parsons, Col. F. J. Hecker, C. E. Grumsky, Gen. George S. Davis, Benjamin M. Harrod, and W. H. Burr. Accompanying the commission were Dr. Col. William C. Gorgas and Dr. Louis La Garde, of the United States army, and Dr. Ross, of the navy, who are to have supervision of the sanitary arrangements on the Isthmus.

The decision of the first Civil Tribunal of the Seine against the Republic of Colombia says of the various treaties made by Colombia: "These articles have the manifest purpose of assuring the full exercise of sovereignty over the canal. It results from what is established before this tribunal, that Colombia is not in possession of the territory traversed by the canal. By coming before a French court in order to sustain its rights over the canal, Colombia tacitly admits its inability itself to control the canal. It therefore follows naturally that it has lost sovereignty over the territory traversed by the canal.

"It also appears that this sovereignty is maintained by the new Republic of Panama, which is in actual possession of the authority and power of administration and of police. Under such circumstances it only remains for the Panama Company to accept the actual situation of authority and the facts relative to the territory embraced by the concession. Therefore the action commenced by Colombia is not receivable."

It will probably require a fortnight to complete arrangements and pass the title, when the $40,000,000, the purchase price, will be paid to the Panama Canal Company, and the $10,000,000 to the Panama government.

STEEL ROADS FOR COUNTRY DISTRICTS.

At this time of the year, when the frost is coming out of the ground and nearly all the roads in and around our country towns are long lines of mire, one cannot help wondering, when considering the subject of our highways, why the government is not quicker to respond to the appeals for aid in their improvement, and why it does not push the adoption of a system of roads that will last for long periods with but slight expenditure for repairs.

Nearly seven years ago the office of Road Inquiries of the Department of Agriculture conducted experiments with steel rails for use on country roads, and made arrangements with a large steel works for the rolling of suitable rails for this purpose. At that time the 8-inch rails for a mile of steel roadway, weighing about 100 tons, could be purchased for about $3,500, and the price has not increased much since. A sample steel road two miles in length between Valentia and Grao, Spain, had then been in use for five years under exceedingly heavy traffic, and had shown splendid results; yet the United States did not, and has not as yet, profited by this experiment in an ordinarily unprogressive foreign country, and we have to-day no steel roads for commercial purposes save the short section in Murray Street, this city, laid about a year and a half ago. As for the foreign example mentioned, during the time it has been in use, the annual cost of maintaining the roadbed has been $380, against $5,470 yearly expended to keep the flint stone road which preceded it in repair. The average traffic over this road is 3,200 vehicles per day. This example of a steel road and its lasting qualities is not the only one abroad, but it is the most noteworthy.

But aside from the permanency of such a road, and the slight expense of keeping it in repair, the greatest advantage that it offers is the reduction in power required to haul loads over it. Tests have shown that while it requires five times as much power to pull a given load on a loose gravel or dirt road as it does over good macadam, and ten times as much power to pull the same load through loose sand or mud, on steel rails only one-sixth as much power is needed as on macadam. This great reduction in power, and consequent diminishment of wear and tear on draft horses, is all the more valuable in that it is permanent and lasts throughout all seasons; so that the farmer is not obliged to figure on a greater loss of time and fatigue of his horses at one season of the year than at another. If self-propelled vehicles are considered, these need not be nearly so powerful as they would otherwise have to be, and they can be operated with great economy. The importance of a special track for self-propelled vehicles was recognized in the early days of the locomotive. Such a track was built and improved until the steel railway track of to-day was finally developed. Now that the self-propelled vehicle has again come on the scene in the form of the automobile, it has drawn attention to the needs of good roads for all vehicular traffic, since the increase in power needed to pull a machine through the mire can no longer be "whipped out of the horse," but must be drawn from a large reserve, and, in the case of the electric automobile, can be accurately measured on every machine. Thus, when it is brought directly to one's notice, and the total mileage of the machine is greatly reduced because of it, the owner sees his expense account rapidly rising, and demands a better highway. This demand is soon to be fulfilled by private corporations, which have recognized it, and have devised systems of steel roads that can be built at no greater cost than a macadam road, and maintained at far less expense. It is to be hoped that the supervisors of roads in the various States will investigate the steel road more thoroughly, and that trial sections may be built for the purpose of comparison with the best macadam roads.

CAST-IRON COLUMNS IN THE DARLINGTON HOTEL COLLAPSE.

Commenting editorially on the Darlington Hotel disaster, a day or two after it happened, we said: "Long before the falling of the building, it was suspected that a considerable amount of 'jerry' work was being done on the bastard steel structures which are being run up continually in this city. We use the term 'bastard' advisedly; for a structure that extends ten stories in height and depends for its rigidity upon the lugs and flanges of miserable little rectangular *cast-iron* columns, has no rightful claim to the reputation for strength and security that goes with the term '*steel* construction.'"

In the intervening month since these words were written, the testimony presented before the coroner's jury has abundantly substantiated their truth. A large number of possible causes for the collapse were suggested, such as faulty foundations, excessive loading of the top floor, framework being out of plumb, changes in plans (although apparently only minor), improper jacking up of the lower framework while replacing a defective cast-iron column; failure of a cast column about the fourth floor, and others. Probably several of these causes co-operated to start or intensify the ruin, but one prominent fact was referred to again and again, both on the stand and the street, namely, the improper use of cast-iron columns in a structure of this character. This point was not included in the jury report, perhaps because the criminal features of their work demanded first attention, or because of a natural but mistaken reluctance to antagonize local foundry interests. We say mistaken reluctance, for the most far-sighted iron founders agree on the futility of endeavoring to force the use of a material into lines for which it is unsuited.

Good cast iron is strong when subjected to compression, but against tension or bending strains it is notoriously weak, and its reliability is further decreased on account of hidden internal defects. The practical impossibility of securing sound castings from even the most reputable foundries is borne out in the Darlington disaster, where the experts of both the Building Department and the District Attorney found that the "fairly good" cast-iron columns used possessed flanges from one-third to 40 per cent defective. As a result of these latent defects, tensile weakness, internal cooling strains, and the danger of water freezing inside and bursting their hollow shells, the use of cast-iron columns should be limited to simple cases of direct compression where there are few complicating elements.

The skeleton frame of a building is subject to two kinds of strain, namely, direct compression from the weight of the structure and contents, and a bending

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tendency due to wind, which in high buildings with narrow base is considerable. In low buildings, where there is no other consideration but direct compression, sound cast-iron columns form a suitable material; but in lofty structures even this direct stress is complicated by the tendency of all loaded columns to buckle sidewise when their length is excessive, and this must be resisted by lateral bracing for which cast iron is not adapted; moreover when there is added the bending due to the overturning efforts of the wind, there arise conditions of design and detail to which cast columns are entirely inadequate.

There are many architects and engineers in New York who can safely be intrusted with the safety of public, laboring, and property interests in the design of such structures; but for the much larger body of the less experienced the building code should be carefully amended and enforced. Demand has been made for superintendents with five years' experience, and for a sufficient staff of competent inspectors empowered to enforce the code; but the Darlington disaster strongly teaches that all obscurity should be eliminated from the code itself, and specifically that the use of cast-iron columns be absolutely limited to wall-bearing buildings, and to those less than seventy-five feet in height.

THE STEAM TURBINE AND ITS FIELD IN MARINE WORK.

BY LIEUT. H. C. DINGER, U. S. N.

The steam turbine continues to develop with improvements in economy, a lessening in weight, and more ease in manipulation. That it has a future useful and brilliant can no longer be doubted. At the same time, there is no immediate likelihood of reciprocating engines being displaced on steamships in general and relegated to the dump as relics and bygone devices.

A brief *résumé* of the peculiar advantages of the turbine, in distinction from the reciprocating engine, viewed from a practical standpoint, may be seen in the following:

For the same power delivered at the shaft, it is considerably lighter than the reciprocating engine. This relative weight is, however, liable to be a very misleading factor, since the weight of quite similar installations of reciprocating engines differs very widely. The weight of the turbine engine alone (Curtis) on the yacht "Revolution" is 8¾ pounds per equivalent I. H. P., while the weight of United States torpedo-boat engines alone is about 11½ pounds per I. H. P. As the torpedo-boat engines are built especially light and the "Revolution's" turbine was not, the probable advantage of the turbine, when developed, will be greater.

In the turbine, there are no other than the shaft bearings, and hence the cost of lubrication almost disappears. Roughly, in marine work one gallon of oil is used per ton of coal; and as a gallon of oil will cost about one-tenth the price of a ton of coal, it can be seen that there are presented very favorable conditions for materially reducing running expenses.

Fewer attendants are required, and thus the wages bill of the engine-room force can be greatly reduced, since the oilers for main engines can be dispensed with.

The space required will not differ very materially from what is necessary for the reciprocating engines, but less height and less length are needed, so the turbine does have some advantage here, and in special cases very material ones. However, for large, moderate-speed merchant vessels, the slight decrease in space will not be of very great importance. Little noise and no vibration are produced by the turbine engine. There is little likelihood of breakdown, and the turbines can run for very long periods without any necessity for adjustment of parts, since the tangled mass of joints and bearings that, in a reciprocating engine, may get loose, are absent. To secure good efficiency, the turbine must have a high peripheral speed. This can be obtained by a high number of revolutions or by an increase in diameter of the turbine disks or drum. To secure economical results, there must be a very good vacuum. When running at reduced speeds, the turbine decreases very materially in economy.

From the above, some idea of the peculiar sphere of the marine turbine may be gleaned. The favorable conditions are: 1. Continuous running at full power. 2. Where a high number of revolutions is not objectionable. 3. Where there is a desire to avoid vibrations. 4. Where saving of weight and space is of great importance. 5. Where economy in running expenses is important. Where a reduction in the number of attendants is greatly desired. It may be observed that not every type of craft presents conditions favorable to the use of the peculiar advantages of the turbine.

It would not seem to be suitable for tugs, ferryboats, or passenger steamers making short trips and frequent stops, because these are constantly stopping and starting, and do not run continually for any length of time. Moreover, for towing, a comparatively low number of revolutions is desirable. It is, likewise, not peculiarly suitable for large, slow freighters, on account of the desirability of having a low number of revolutions for propellers, and the characteristics of less weight and no vibration are here not of very great value. It is not peculiarly suitable for moderate-speed men-of-war, because they do not, as a rule, run full power for any length of time, and it is also here not desirable to have a high number of revolutions for propellers.

The types that the turbine would be suitable for are: Fast passenger steamers, making long trips at full speed. Here economy, less weight, no vibration, and reduction in attendants are greatly desired, and a higher number of revolutions for the propellers is more advisable. In fast scouting cruisers and torpedo boats the desideratum is a maximum speed on the least weight, with no special desire for economy at low speeds. In this case, anything that will reduce weight and the number of attendants will bring very potent advantages.

TYPES OF TURBINES.

The two types of turbines proposed for marine work in this country are the modified Parsons, built by the Westinghouse Company, and the Curtis turbine, being now largely built by the General Electric Company. The chief distinguishing point of difference between these two types is that in the Parsons turbine the expansion of steam takes place while passing through the turbine vanes. The casing in this type is under pressure, while in the Curtis turbine the expansion takes place in nozzles, and the casing in this case is not under pressure above that of the expanded steam. Owing to these differences, the Parsons turbine is long and the casing has to be designed heavy to stand the pressure of the steam. The Curtis turbine is much shorter, and the casing can be made lighter.

Some of the principal points that a successful marine turbine should possess may be stated as follows: It must be easily reversible. This can now be successfully accomplished in both of the above types by providing a set of backing vanes on which steam may be caused to act by opening the reverse valve and by closing the one admitting steam to the go-ahead side.

It should be as light as possible, and for this reason it would seem that the expansion, and hence heavy pressure, should be confined to the nozzles (which are small) so that the casing may be made light. Supposing we have an absolute pressure of 250 pounds and a vacuum of 26 inches. The total expansion possible is 125 times. If this is divided into three stages, there will be an expansion of five times in each stage. Expanding 250 pounds five times gives 50 pounds absolute, and again five times, 2 pounds absolute or 26 inches vacuum. If the expansion takes place in the nozzle, the first part of the casing has to stand 35 pounds per square inch, while the remainder of the casing may be under a vacuum. In this way, the necessity for a great weight in the casing is obviated.

The expansion should be complete in each turbine engine, and not divided into H. P. and L. P. on different shafts. Each engine should be entirely independent.

The number of revolutions should be reduced sufficiently to keep speed of rotation of propellers below a point where any great loss due to cavitation is likely to result.

The number of parts should be reduced, and hence the mounting of turbines on a single drum, as in the Westinghouse Parsons type, would have advantages over the separate disks employed in the Curtis and Rateau.

Extreme fineness of adjustment should not be absolutely necessary, as it cannot be expected that there will be specially fine appliances or expert personnel on every vessel. Where the expansion takes place between the vanes, clearance must be very little, and bad adjustment is likely to result in considerable loss. On the other hand, when the expansion takes place in a nozzle and the steam acts by impact, clearance will not be such a great source of loss.

A high vacuum is important. The economy will depend on the number of times the steam is expanded. Supposing there is a pressure of 200 pounds absolute and a vacuum of 26 inches or 2 pounds pressure absolute. Then there are 100 expansions. Supposing vacuum drops to 24 inches or 3 pounds; the expansion is here only 66 2-3 times. If vacuum is increased to 28 inches or 1 pound, there are 200 expansions. Taking variations in pressure, suppose pressure is lowered 50 pounds, so that we have 150 pounds and 26 inches vacuum; the number of times the steam can expand is 75. It can thus be observed that a drop of 2 inches in the vacuum makes more difference in the relative economy than a drop of 50 pounds in the steam pressure. This is an important point to always have in mind.

It may then be stated as a broad principle that the economical efficiency of the turbine will depend directly on the efficiency of the condenser and air pump, and that for practical results even more attention must be paid to the efficient design of air pump and condenser than to the details of the turbines themselves. It may also be observed that turbines should be more efficient where there is cold injection water, and that if turbines are installed in torpedo boats, a good separate air pump must be supplied.

SUPERHEATED STEAM.—Another great field that the turbine may develop, and to which it peculiarly adapts itself, is the use of superheated steam. In the reciprocating engine, superheated steam is quite objectionable, owing to the difficulty presented by internal friction and the great wear caused to cylinders and valve liners. With turbines these difficulties are entirely absent, and the advantages of superheated steam can be made use of to the limit of its development. The turbine thus presents at the start the possibility of greater economy than the reciprocating engine.

OBJECTION TO OIL.—As the turbine does not use any oil for internal lubrication, the difficulties due to the use of cylinder oil getting into boilers will be greatly lessened, but as various auxiliaries and pumps will be driven in the same way as heretofore, this trouble will not be entirely eradicated.

POSSIBLE GAIN IN WEIGHT.—Although the turbine engine may be considerably lighter than the reciprocating engine, the gain in less weight of machinery will not be very great. The weight of main engines is only a part, and not the major part, of the weight of the machinery installation. The boilers roughly weigh half, and the auxiliaries in engine rooms on men-of-war weigh more than the main engines. The main engines with crank shafts on recently completed battleships weigh from seventeen to twenty per cent of total machinery weights, so that should there be a reduction of fifty per cent in the weight of main engines by the use of turbines, there would only be a reduction of less than ten per cent in the total weight. But as there may be an increase in condenser weights and weight of air pump, the probable figure will not be much more than five per cent. It can thus be seen that for men-of-war no overwhelming reduction of weight is likely to result. In merchant vessels, the main engines are so much larger a percentage of the total weight, that here there will be a greater percentage of weight saved.

The apparent points of advantage that will probably bring the turbine into use are: 1. Reduction in cost of production for same power, when the manufacture has developed sufficiently. 2. Reduction in running expenses produced by less attendants and almost non-use of oil, and reduction in repairs and overhaul. It may be a question whether this decrease in running expenses will counterbalance a probable increase in steam consumption under the conditions imposed on board ship; namely, low revolutions and variable output. This, of course, can only be told by actual trial. The data at present available on this point are not much more than guesswork. It is these practical points in the matter of the expense account that will determine the adoption of the turbine for general work in the merchant marine. In the navy there are a number of other matters that should be considered.

SCIENCE NOTES.

In the Royal Society Proceedings there is described a comparison of plants grown under normal conditions with similar plants grown in an atmosphere containing about 3½ times the normal amount of carbon dioxide. The investigators, Dr. Farmer and S. E. Chandler, state that under abnormal conditions the internodes remained shorter and the surface growth of the leaves is arrested earlier. The number of stomata per unit area of leaf is much greater, but, owing to the reduced size of the epidermal cells, the proportion of stomata to epidermal cells is not altered; the guard cells of the stomata are not, however, reduced in size. The anatomical structure of the stem varies very slightly, in some cases the wood vessels are fewer in number, and this is probably correlated with the diminution in size of the leaves, although disturbance of the general metabolic processes is also quite a possible explanation.

According to Dr. Graham, of Beirut, another disease is to be set down against the mosquito, namely, dengue fever, variously called African fever, break-bone fever, giraffe fever, dandy fever, etc. The disease is an acute eruptive fever, rarely fatal, but leaving various disagreeable sequelæ—paralysis, insomnia, marked mental and physical prostration, etc. It occurs in hot climates and in the Southern States; during the last fifty years several serious epidemics have occurred. Dr. Graham found that he could regularly produce an attack of dengue in a non-immune by submitting the latter to the attack of mosquitoes which had fed on sufferers from the disease. In one experiment he carried dengue-infected mosquitoes to a mountain town 3,000 feet in altitude, where there were no mosquitoes and no dengue. One of the natives was shut up in the room with the mosquitoes, and on the fourth day came down with a sharp attack of dengue, and a second presented the typical symptoms on the fifth day. The mosquitoes were immediately destroyed, and no further cases occurred. Dr. Graham also claims to have discovered the germ which causes dengue in both human blood and the stomach of the mosquito. It resembles some forms of the malarial parasite.

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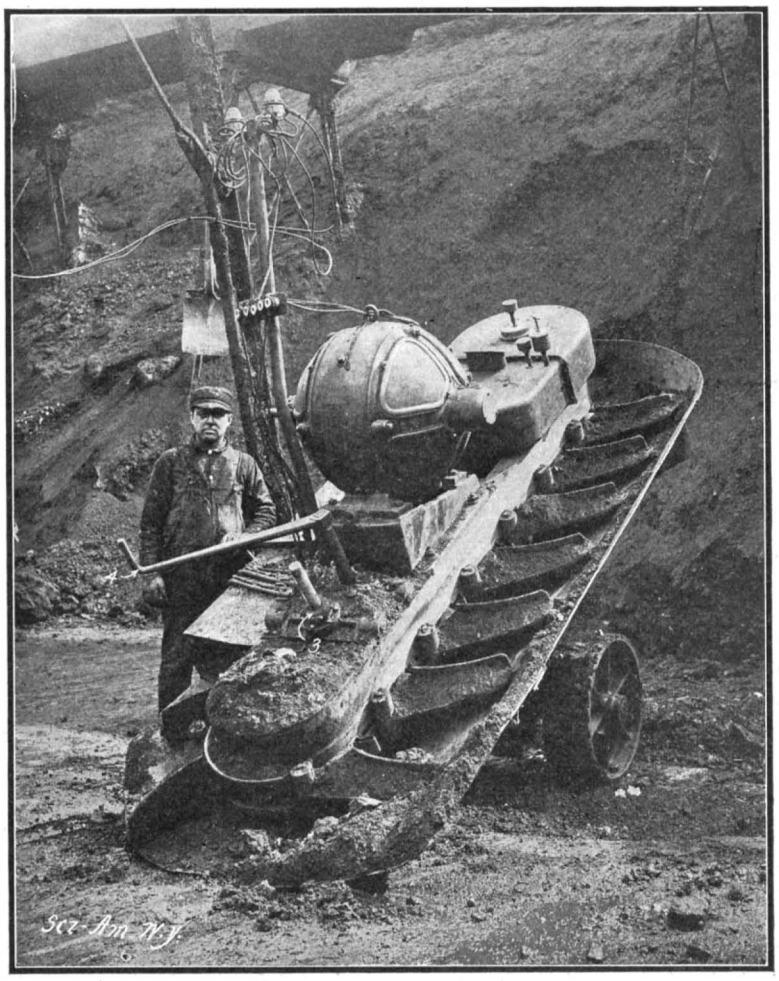
AUTOMATIC ORE LOADER.

The accompanying illustrations of an automatic ore loader present an interesting case of the substitution of automatic machinery for hand labor. They represent a movable automatic loader, which is used at the furnaces of the Illinois Steel Company at South Chicago, Ill. It is shown backed up to the great ore dump that ranges parallel with the blast furnaces, where it is engaged in loading the iron wheelbarrows in which the furnace charge is wheeled to the charging buggies at the foot of the elevators. The machine, which is built by the Park Manufacturing Company, of Chicago, consists of an endless chain of metal scoops which are mounted on a stout metal table, the table itself being mounted pivotally on a truck, to enable it to adjust itself to the pitch of the ground and the height to which the material is to be elevated in loading. The chain of scoops, which is driven by an electric motor, passes around sprockets arranged at the opposite ends of the machine. By means of chains, sprockets, and suitable clutches, the electric motor also serves to propel the loader, moving it to any desired point of the yard. This particular type of machine has been tested successfully in the handling of limestone, coal, and salt, and it has shown a considerable saving of time and money in loading over hand labor with a shovel. The capacity of the machine is 90 cubic feet per minute of loose material.

The control of the loader is arranged so that the operator can handle the machine conveniently from the right-hand side of it, as shown in the illustration. Conveniently to hand there is a main clutch, 1, for operating the scoops or "flights," while adjacent to that is a lever, 2, for throwing in the propelling clutches. At the front end of the machine is a screw, 3, for adjusting the height of the forward edge of the machine. No. 4 is a steering lever, used when transferring the loader from one place to another. There is a cam arrangement upon the driving wheel, by which, when the front wheel is turned, a clutch on the inside wheel is withdrawn, making the outside wheel a driver and rendering it possible to turn the machine end for end in its own length. The loader can also be mounted on a truck provided with flange wheels, and used in mines or in tunnel work, in which respect it shows to good advantage. If it is desired, a secondary conveyer is provided, which serves to elevate the material to a height of 10 feet or more for discharging into railway cars or wagons, the 10 horse-power of the machine being found sufficient to enable the loader to haul its own secondary conveyer with it. The average capacity of the machine illustrated is 90 cubic feet per minute of loose material.

The method of operation of the loader is clearly shown in the engravings. The front edge of the table is lowered until it rests upon the ground, and it is thrust forward against the bottom of the pile of material. As the arms sweep around, each gathers a certain amount of the material, carries it into and up the carrying channel, until it reaches the upper end of the machine, when it is delivered, as shown, into the desired receptacle. As the arms travel at a rate of 60 to 80 feet per minute, and the carrying channel is 18 inches wide, by 16 inches deep near the inner wall of the channel, there is an actual carrying capacity of 1½ cubic feet for every foot of travel of the chain; or say, from 80 to 100 cubic feet per minute.



3. Screw for raising and lowering front of machine. 4. Steering lever.

AUTOMATIC ORE LOADER. FRONT VIEW.

Novel Method for Entrapping Submarine Boats.

During the recent naval maneuvers of the British Channel squadron off Portsmouth, a novel method of entrapping and disabling submarine boats was attempted, and the efforts were crowned with complete success. The submarine boats were attached to the squadron acting as defending vessels, and their object was to frustrate onslaughts and put out of action the attacking battleships.

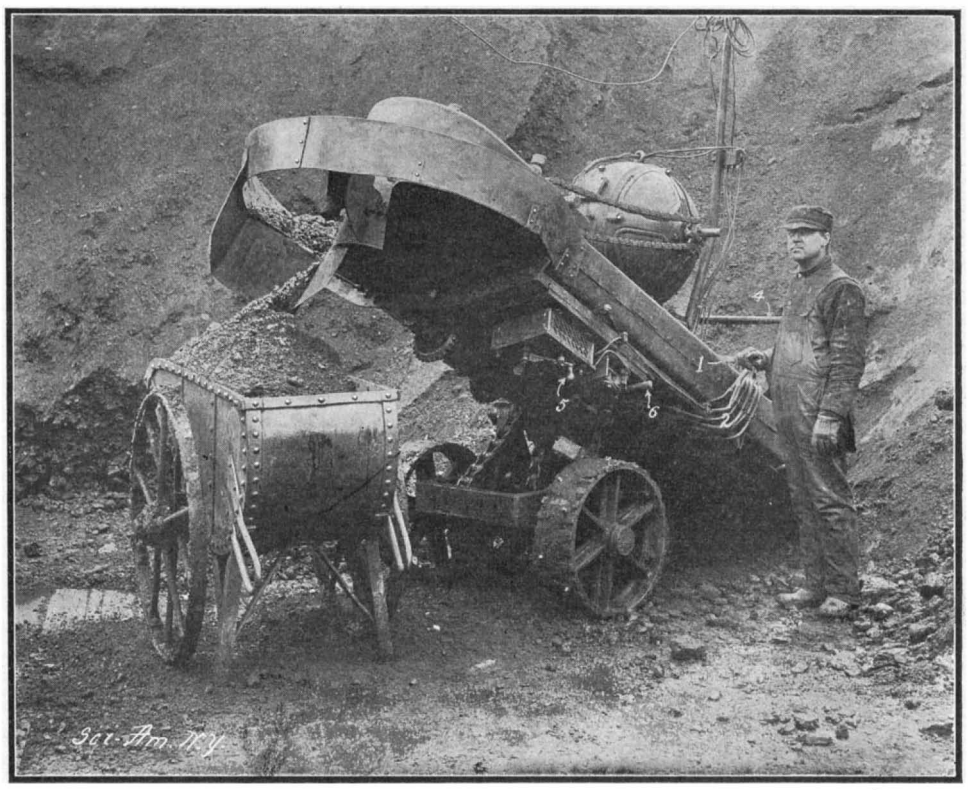
The larger armorclads of the attacking vessels kept well out to sea, and confined their efforts to firing upon the forts from long range. The torpedo boats and other similar lighter craft, however, rushed to the attack. While this movement was in progress, and the undivided attention of the defending force attracted entirely thereto, the battleships of the enemy quietly dropped picket boats, manned with full crews. These craft are small, light, mobile, and easy to handle, though they can steam at from sixteen to eighteen knots an hour. Their scope was to destroy the submarines, and for this work they are admirably suited, for they are inconspicuous, offer a small target, and are speedier than the submarines, which only travel about ten knots on the surface, and six or seven knots when submerged. Moreover, submarines travel only from ten to twenty feet below the surface.

Each picket boat was equipped with some fine nets of specially fine hard steel. When expanded, they stretched to 70 feet or 100 feet in length, and were fairly broad. Along one side of each net a hawser was threaded. One end of this hawser was attached to a compensating drum on one picket boat, and the other end was fixed to a similar arrangement on a second picket boat. The net thus rigged at once sank down like a thin wall into the water.

Owing to the fine, delicate construction of these nets, they can be dragged through the water like a fisherman's sieve by the picket boats at a pace far in excess of that of a submerged traveling submarine. This curious process of fishing, or trawling, for submarines was eminently successful. Officers on the picket boats attached to one of the nets saw a periscope moving on the surface of the water. They immediately maneuvered their boats so that the steel net was stretched across the submarine's path. The submerged boat continued its progress, unsuspectingly. In a few minutes the officers in the picket boats at either end of the hawser felt a straining, which told them that they had stopped the career of the submarine. Immediately the boats altered course, so as to completely envelop the unfortunate underwater craft in the net. The maneuver was crowned with absolute success. The submerged craft was completely caught.

To accentuate further the predicament of the sailors in the submarine, the hawser carried away the periscope, so that the navigators of the submerged craft were deprived of their sole means of seeing what was happening on the surface, and consequently the crew could do nothing but await developments. By some means or other the picket boats contrived to raise the submarine to the surface, and its capture was completed.

The success of this experiment opens new possibilities of frustrating the attacks of submarines, if not capturing them. It was conclusively demonstrated on this occasion that once a submarine is enveloped in the meshes of such a net—it must be very fine and strong—it is impossible to escape, and the boat is as helpless as a fish under similar circumstances. The destruction of the periscope, too, as this instance proved, completes the helplessness of the submerged boat. If the submarine cannot be raised or forced to the surface and then captured, the picket or other boats have simply to stand by and await until the need of a fresh supply of air forces the vessel to rise, when its capture can be effected.



1. Main clutch. 2. Lever for propelling clutches. 5. Starting box for motor. 6. Circuit breaker.

AUTOMATIC ORE LOADER. REAR VIEW.

The Submarine and the Searchlight.

In Narragansett Bay on the evening of November 11, there was an elaborate test to determine the usefulness of submarine boats in naval warfare, the purpose being to see if they were less visible at night than surface boats, if they could be navigated successfully and safely in the dark, and if the playing upon them of numerous searchlights hampered the making of observations from their conning towers.

The test partook of the nature of a sham battle, in which Fort Adams and the torpedo station, with strong searchlights and large parties of army and navy officers acting as observers, and the tug "Peoria," anchored west of the torpedo station and using a powerful searchlight, were opposed to the submarine boats "Moccasin," "Adder," and "Plunger" and the surface boats "McKee" and "Morris," as well as "Torpedo Boat No. 1."

Of the six craft afloat, the "Adder" alone lived through the battle, and she succeeded in eluding all the watchers and getting into a position so close to the tug "Peoria" that she easily could have annihilated her. It was, in fact, a clean-cut victory for the "Adder," which was in command of Lieut. Frank L. Pinney. The watchers at Fort Adams picked up with some little difficulty the submarine boats "Moccasin" and "Plunger," and they searched in vain for the "Adder."

It was learned that the navigation of submarine boats in the dark was practicable, and that the playing upon them of powerful searchlights did not much hamper their officers in running them or making observations from their conning towers fairly well. When the light was not playing upon the boats, very good vision could be obtained from the submarines. It was proved that the submarines were less visible in the dark than the surface boats.

Rotary converters operated six-phase will give from 35 to 45 per cent greater output than when operated three-phase, according to an article by Mr. A. S. M. Allister in the American Electrician. Hence economy dictates three-phase transmission, with transformation to six-phase at the converters. The simplest method is to use three transformers, the primaries being either star or delta connected and the secondaries star connected. A delta connection on the low-tension side, as well as on the high-tension side, has, however, the advantage that the breakdown of one transformer does not render the plant useless, as the two remaining transformers take the load of the missing one.

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PULLING STRENGTH OF MEN AND ANIMALS.

There have been comparatively few authentic tests made of the actual pulling power of draft animals and, therefore, the trials recently carried out by Barnum & Bailey's circus at Madison Square Garden were of sufficient interest to attract quite a large gathering of qualified observers. The heavy dynamometer shown in our engravings was used. This instrument, which has a maximum capacity of 100 tons, was manufactured some years ago for the Merritt & Chapman Wrecking Company, passing later into the possession of the circus company. For the purpose of these pulling experiments it was sent to the makers, where it was overhauled and tested, to make sure that the results of the draft trials would be thoroughly reliable.

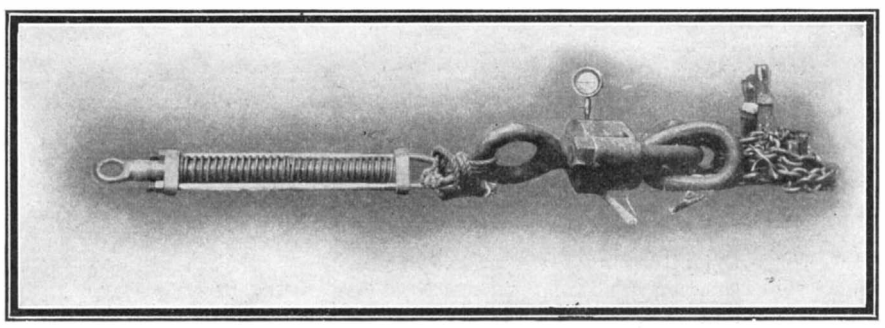
The machine is of the hydraulic type, with a piston having 25 square inches of surface. The cylinder is filled with glycerine and it is provided with a pressure gage which will be noticed in our engraving, attached at the top of the cylinder. One end of the dynamometer was secured to heavy stakes driven into the floor, and at the other end, between the hauling ropes and the dynamometer, was interposed a pair of powerful springs with about 2 feet of maximum compression. The object of the springs was to allow the draft animals to apply their strength gradually and give them a certain amount of movement in the act of pulling.

There is a curious psychological (if we may use the term) reason for the use of this spring. Without it, if the animal is pulling direct on the dynamometer, as soon as he bears on the collar or breast strap, he is pulled up and realizes that the load is immovable. This discourages him, and after the first jerk he is apt to relax his efforts. With the spring interposed, however, he feels a certain amount of give to the load and is able to make a slight forward movement. Encouraged by this, he will throw himself more heavily into the pull than when no spring is used. The effect was further increased by using a long instead of a short rope. The accompanying table tells the story of the trials. The last column, in which is tabulated the amount pulled per pound of weight of the man or animal, as the case may be, shows that the best result was obtained by a team of horses of 1,600 pounds weight, which pulled 1,875 pounds per horse, or 1.172 pounds per pound of their own weight. It will be noticed that the result was much better than that obtained when six horses were coupled up; although the six horses were individually heavier. This is explained by the fact that there was difficulty in getting the six horses to pull together. The men showed up well, the results with fifty men on the rope being very much better than when a hundred tailed on. This was to be expected, the hundred men being so close together that there was no opportunity to get a good footing, or to get a pull in line with the rope. Assuming an average weight of 150 pounds per man, which is the commonly accepted average, we find that the men with fifty on the rope did almost as well in proportion to their weight as the horses. This can be explained by the fact, that understanding the conditions, they gave a longer and steadier pull, and were not discouraged by the fact that the load did not move. The elephant, a seasoned veteran, that has done a great deal of hauling and pushing of cars and wagons for the circus, did his best work when hitched up by a couple of 1¾-inch ropes to the dynamometer, with the spring interposed. His weight is 12,000 pounds and he pulled 8,750 pounds. This, although it looks like a splendid result as an effort of a single animal, still ranks lowest of any in the table when tested on a basis of pull per pound of weight, the result being only .729 pound as against 1.172 pounds for the horse.

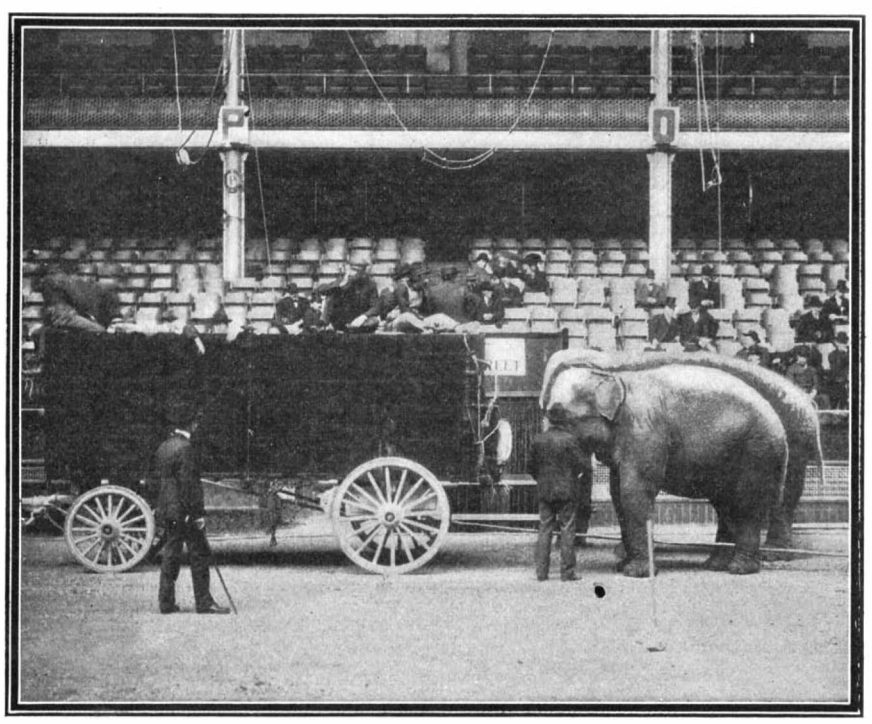
Another of our photographs shows the method by which the pushing strength of the elephants was tested. Two of them, known as "Babe" and "Albert," the latter weighing 10,000 pounds, pushing together, raised the pressure gage to 6,500 pounds. It was quite a surprise to the management to find that the elephants could pull so much more than they could push, for it has been customary to utilize the strength of the elephants by making them push instead of pull the wagons. "Babe," when pushing alone, showed a result of 4,500 pounds. The push was registered by fastening a rope from the wagon to the dynamometer, padding the rear end of the wagon, and putting the elephants in the position shown in our engraving. As an instance of the actual work of which the beasts are capable, it may be mentioned that "Babe" when in the railroad switching yards can easily push three loaded freight cars.

PULLING STRENGTH OF MEN AND ANIMALS.

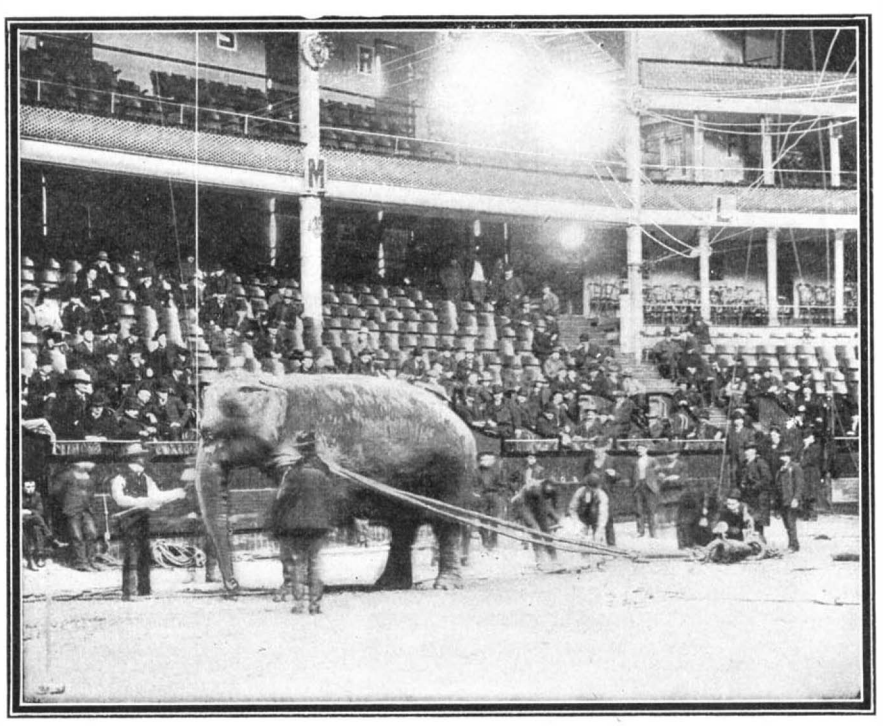
No.	Description.	Weight of each in lbs.	Total Pull in lbs.	Pull Per Unit.	Pull Per pound of Weight.
2	Horses	1,600	3,750	1,875	1.172 lbs.
50	Men	150	8,750	175	1.166 "
100	Men	150	12,000	120	0.8 "
6	Horses	1,800	8,875	1,479	0.822 "
2	Camels	1,800	2,750	1,375	0.764 "
1	Elephant	12,000	8,750	8,750	0.729 "



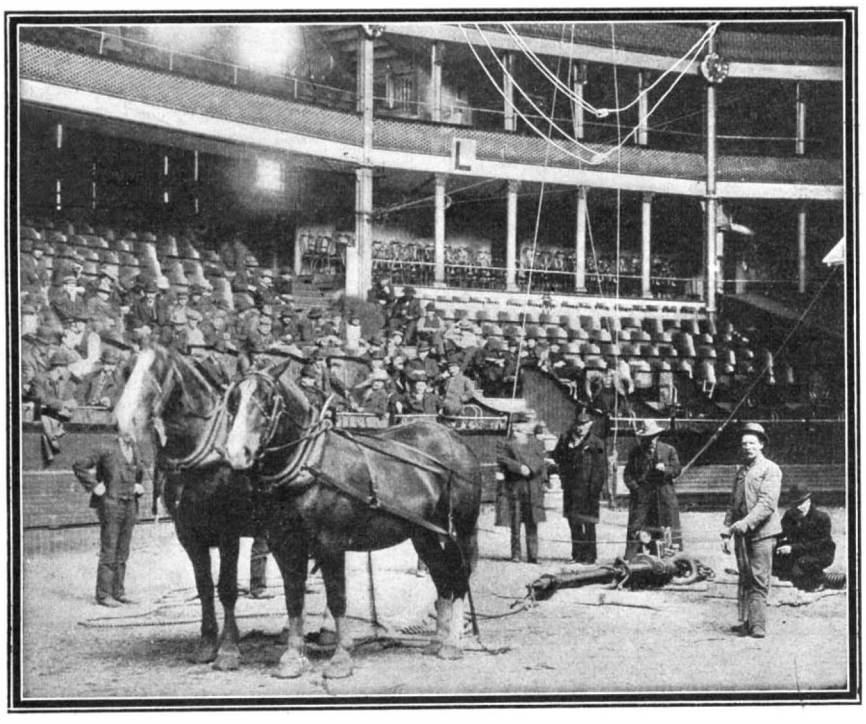
The Hydraulic Dynamometer With Which the Tests Were Made.



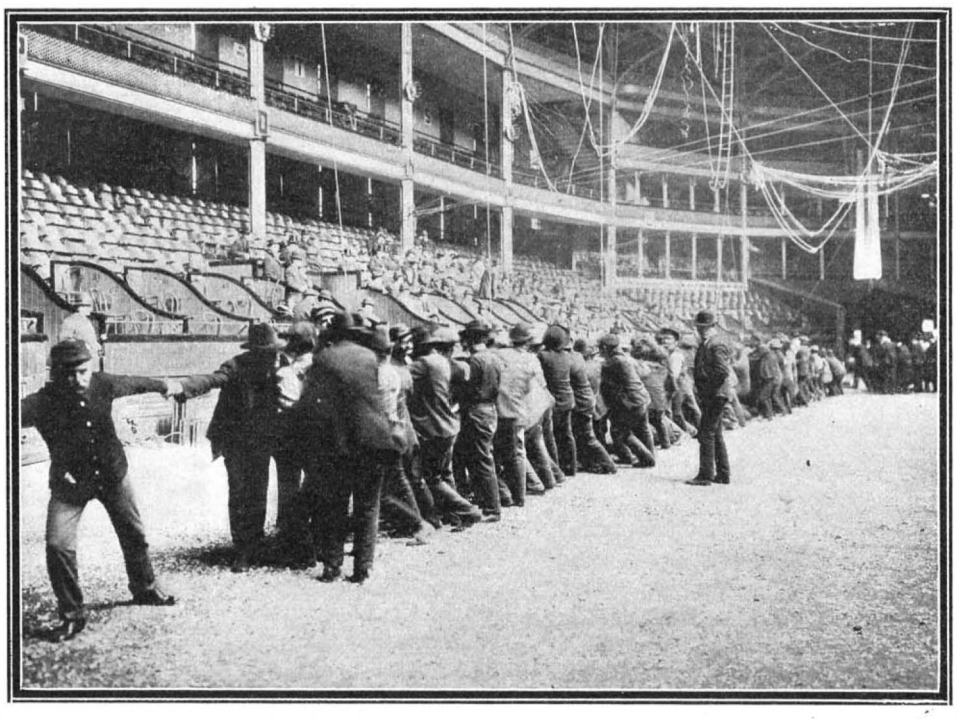
Two Elephants Ready for Pushing Test. Amount Recorded, 6,500 Pounds.



Elephant, Weighing 12,000 Pounds, About to Make a Pull of 8,750 Pounds.



These Two 1,600-Pound Horses Registered a Pull of 3,750 Pounds.



One Hundred Men Making a Pull of 12,000 Pounds.

Rotterdam was visited last year by 7,652 vessels, measuring 7,626,263 tons, against 6,855 ships and 6,600,549 tons in the year 1902, being an increase of 797 ships and 1,025,714 tons.

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Meteorit—A New Aluminium Alloy.

Mr. Walter Rubel, a German civil engineer, has been carrying on a series of promising experiments with a metal of his invention which is nothing more or less than an alloy of aluminium and phosphorus. The new metal (called "meteorit") is no mechanical mixture of aluminium and phosphorus, but a chemical compound. No disintegration can therefore take place in melting or casting. According to the quantity of phosphorus used, meteorit can be made in various grades of hardness. Later tests proved that the material is very dense and highly polishable. For scraping, the metal is in no way inferior to white, or to red metal. Meteorit is well adapted to planers and shapers. No smearing is noticeable. This is a special feature of meteorit, as all other known alloys of aluminium are likely to smear the shaper. The cutting velocity is very high, which, for economical reasons, is to-day of importance in machine construction.

Meteorit has the same low specific gravity as aluminium, viz., 2.6 to 2.8, which is of great importance in branches of industry where the material is employed in large quantities, especially in motor-car construction.

The new metal is well adapted to machine construction, as has been amply demonstrated by the tests made in the technical institutes at Charlottenburg, Munich, and Duisburg. The following are the results of comparative tests between meteorit, magnalium (an alloy of aluminium), and pure aluminium, made and officially attested by the Royal Mining School at Duisburg. Tests made with rods on May 13, 1901. Diameter 20 millimeters. Tensile strength:

		Contraction.
Cast meteorit	5,010 kilogrammes	43 per cent
Magnalium	3,150 kilogrammes	11.7 per cent
Aluminium	2,720 kilogrammes	7 per cent

Further tests made with regard to the various other requirements have given the following results:

	Rolled material.	Cast material.
Ductile strength	23 kg.	16 kg.
Tension	9.5 per cent	6 per cent
Pressing resistance per square millimeter	———	58.5 kg.
Gravity	———	31 kg.
Bending resistance	———	27.3 kg.
Contraction	———	43.84 kg.

The metal is acid-proof and non-corrosive in the presence of acetic acid.

Meteorit is, furthermore, in no way affected by the temperature, and is, therefore, specially adapted for many objects intended for outdoor use. Its durability in sea water, combined with its lightness, makes it an ideal material for shipbuilding. It must be stated that, wherever rolling material is used, meteorit is said to possess unsurpassed features of its own, and sheets have been made from 3 mm. (.118 inch) to 0.06 mm. (.002 inch) in thickness, of first-class quality, very hard as well as soft, the latter being intended for further manufacturing into tubes and for cutting and stamping. The German arms and ammunition factories in Karlsruhe, as well as the Swiss and Russian governments, are now making cartridge shells of meteorit.

Meteorit can be soldered and galvanized (nickel, silver, or copper) as easily as other metals, and therefore it can be given any coloring that may be desired. This has up to now not been possible with aluminium.

Information Concerning the Mexican Cotton-Boll Weevil.

The United States Department of Agriculture has just issued Farmers' Bulletin No. 189, "Information Concerning the Mexican Cotton-Boll Weevil." It was prepared by W. D. Hunter, special agent in charge of cotton-boll weevil investigations, division of entomology.

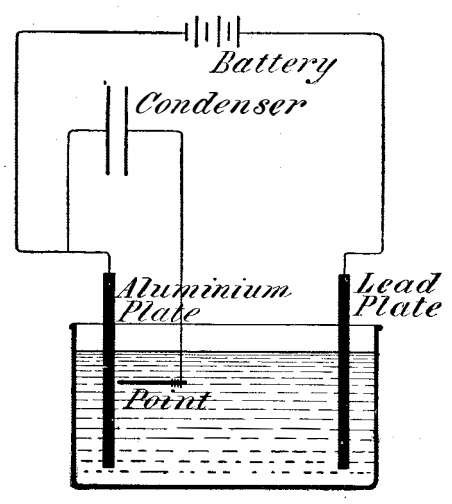
The work of the division of entomology for several years has demonstrated that there is not even a remote probability that the boll weevil will ever be absolutely exterminated. Although the very large yields of cotton of former years may perhaps no longer be possible, it is nevertheless entirely feasible to produce cotton at a margin of profit that will compare favorably with that involved in the production of most of the staple crops of the United States by what have become known generally as cultural methods. These methods consist of modifications of the system of cotton raising made necessary by the weevil. They were originally suggested by a careful study of the life history and habits of the pest, and naturally any improvement that may eventually be made will be the result of the continuation of that study. They have been tested successfully on a large scale by the division of entomology, as well as by many planters, during two very unfavorable seasons. These methods are in brief as follows: First. Plant early. Second. Cultivate the fields thoroughly. Third. Plant the rows as far apart as experience with the land indicates is feasible, and thin out the plants in the rows thoroughly. Fourth. Destroy, by plowing up, windrowing, and burning, all the cotton stalks in the fields as soon as the weevils become so numerous that practically all the squares and bolls are being punctured. Of greatest advantage is the reducing for the next year of the number of the weevils by the destruction of the plants in the fall. The advantage thus gained is followed by bending every effort toward procuring an early crop the following season. Fifth. While fertilizers are not now used to any considerable extent in cotton producing in Texas, there is no doubt that they should be; not that the land is poor, but that crops may be procured earlier so as to avoid a considerable degree of injury by the weevil, which is more destructive to later crops.

The bulletin contains a description of the weevil, the territory affected, and the plan of the investigations by the division of entomology, and gives some of the results of the field work and an experiment showing the damage resulting from favorable hibernating quarters.

The bulletin concludes with an account of the legal restrictions concerning the shipment of infested cotton seed and a warning to cotton planters against the inflation of prices of the seed of certain varieties, and the attempts of unscrupulous persons to dispose of common seed from various localities as that of early maturing varieties.

NEW ELECTROLYTIC PHENOMENON.

A rather curious phenomenon has been discovered by Julius Bing, a German scientist, during some experiments in electrolysis. A vessel contains an aluminium and a lead plate (see diagram) plunged in an electrolyte of tartaric acid. The positive pole of a battery is connected to the aluminium plate and the negative to the lead. The aluminium electrode is connected to one side of a condenser, whose other side has a wire dipping into the liquid. The wire is terminated in a point, which is approached perpendicularly to the plate. It is found that a discharge is produced between the point and the plate, which the author considers due to the capacity of polarization of the aluminium. The energy brought into play by the introduction of the



BING'S ELECTROLYTIC APPARATUS.

condenser is so great that when the point touches the plate, it becomes soldered at once. Therefore he uses a carbon point instead. The heating of the liquid is quite appreciable. The arrangement seems to act as a current interrupter, and the discharge seems to be of an oscillatory character, as the interruptions are accompanied by a high-pitched sound. The frequency of the discharges varies when capacities of different value are inserted. On putting in self-induction, the rate of the discharges is lessened and may be even stopped. The phenomenon is well observed with 150 to 200 volts and a capacity of 15 microfarads, and the interruptions are then regular. At the anode plate is seen a bluish light which disappears at the moment of discharge, but it reappears, on the contrary, when the charge is increased progressively.

Telegraphing Pictures and Handwriting.

In an address recently delivered at the Berlin Urania, Prof. Cerebotani presented a telegraphic apparatus for transmitting any kind of handwriting, drawing, etc. The fundamental principle is identical with the principle employed for instance by Elisha Gray, the novel feature being a highly sensitive system of electromagnets. In the case of the drawing pencil of the transmitter being moved upward in an oblique direction, the line obtained in the receiving apparatus of previously-invented systems is a broken one. In Cerebotani's system, the electromagnets are so sensitive as to produce nearly straight lines, even in the case of their being excited by extremely small currents. The telegraphic transmission of pictures and handwriting, as obtained by means of his apparatus, is therefore much clearer and truer than in the case of any previous apparatus. Some samples produced by Cerebotani were transmitted on the telegraph lines from Munich to Augsburg, from Milan to Turin, and finally from Berlin to Munich. A picture transmitted some weeks ago from Berlin to Munich over a distance of 403 miles is said to be the finest specimen of telegraphic transmission ever obtained in this direction.

Engineering Notes.

A 32-ton iron girder, the seventh of a number which are being used in the construction of a large department store in New York city, attracted no little attention as it was hauled through the streets on a truck 150 feet long. To drag the girder from its dock, twenty-one horses were required. The animals had to stop every few blocks for a rest. Every time that a new start was made, two powerful jacks were brought into use to move the heavy mass.

In the course of the James Watt dinner recently celebrated in Glasgow, the Lord Provost, Sir John Ure Primrose, Bart., described a new method for the raising of steam—a process that not only alters the existing plans of steam raising, but also solves the problem of the smoke nuisance in great industrial centers. The Lord Provost, who is a big manufacturer, had attached to one of the marine type of boilers at his works a furnace that appears to settle the smoke difficulty, introducing at the same time conditions under which, at a given rapidity of combustion, the maximum efficiency in steam is obtained from the fuel used. It is claimed for the patent that it is particularly suited for marine work. It can be used with cheaper and dirtier coal than is employed by the existing systems, so that shipmasters, when in foreign ports, would be in a position to effect the saving that would come from the purchase of local coal. Less boiler-room space is required, and the boiler-room weights are reduced by about one-half. Fuel can be taken either solid or liquid. Air and fuel are fed together, and combustion is effected under ideal conditions, no unconsumed gases escaping from the furnace, and no smoke or carbonic acid gas coming from the funnels.

It is almost the general impression that the late Sir Henry Bessemer was knighted in recognition of the steel process which bears his name, but such was not the case. The honor was bestowed in 1878, when he was sixty-six years old, as a tardy reward for a service rendered the British government about the time of his attaining his majority. The history of this, as told by James Dredge, is that at the time when, in his early years, Bessemer came into contact with some of the officials of Somerset House, the seat of the Inland Revenue Department, it was notorious that frauds on the government were perpetrated to an alarming extent by the repeated use of stamps affixed to deeds. It was estimated that an annual loss of £100,000 was sustained from this cause, and to devise a means for entirely putting a stop to this occupied Bessemer's attention. It is almost superfluous to say that he arrived at a solution by the simplest means, that of perforating the government stamps with dates. Now that this evident method has found a hundred uses throughout the civilized world to safeguard stamps or checks, and to divide postage stamps, being among the most common, it is a little difficult to realize the importance of this invention. To Bessemer it meant, in anticipation, vast things—assured fame, a retaining fee of £600 a year as a government official, and a great advance on the road to fortune. In reality, however, it meant nothing, for though the invention was at once adopted, the official promises were soon forgotten.—Cassier's Magazine.

The experiments described in a paper by Mr. Strahl (see Zeitschrift des Ver. Deut. Ing. No. 2) were made on behalf of the Breslau Royal Railway Department, two high-speed train locomotives being fitted with Pielock superheaters, and compared with two similar locomotives without superheater as to their consumption of water and coal. The main results arrived at may be summarized as follows: The temperature of the steam on issuing from the superheater being 260 deg., the saving as to water vaporized was about 16 per cent, and as to the consumption of coal; 12 per cent, whereas the steam saving proved equal to about 10 per cent for a mean steam temperature of 230 deg. in the dome. The consumption of steam in the different locomotives compared, proved the same for equal outputs. The weights of water vaporized are inversely as the specific volumes of the different kinds of steam, being directly proportional to the specific weight. The saving in steam obtained corresponded with the increase in the specific volume of the steam due to superheating. The saving in steam, being dependent only on the superheat, must be the same both in compound and twin locomotives for equal superheat, the comparison being relative to quite similar locomotives. Slide valves could be used up to the highest temperatures attained (272 deg. C.) provided sufficient oil was supplied to the sliding surfaces by means of lubricating presses. In order to fully utilize the advantage inherent in superheating for a higher efficiency of the locomotive, the cylinders should be increased proportionally to the higher consumption heat (coal) of the locomotive (in the case of equal outputs) without superheaters, as against locomotives with superheaters.

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Correspondence.

Advantages of Salt Water Mains.

To the Editor of the SCIENTIFIC AMERICAN:

Let me call to your attention another possible use for salt water in case it is introduced into this city for fire protection.

Salt water, as is well known, freezes at a much lower temperature than fresh water, and could be used in winter to flush the streets and carry away slush and snow. Fresh water has been used for this purpose, but is limited in its usefulness to mild days, for when the temperature is below freezing, it rapidly forms into ice.

C. MESSICK, JR.

New York, March 31, 1904.

A Letter from Dr. Herty on the Gathering of Turpentine.

To the Editor of the SCIENTIFIC AMERICAN:

My attention has been called to a communication in your issue of February 6, entitled "About the New Method of Gathering Turpentine."

The experiments of your correspondent, Mr. George W. Colin, in the use of detachable boxes, are historically interesting. His assumption, however, of the impracticability of any plan because of the failure of his experiments, scarcely needs comment other than a statement of the fact that at the present time there are at least three million cups in use by turpentine operators, and that this number would easily have been eight million, had the potteries been able to supply the actual demand in time for the present season.

Your correspondent quotes from an article in your issue of January 2 the statement, "New Method of Gathering Turpentine Invented by Dr. Charles H. Herty, and by him given to the public."

I am unwilling to receive credit for generosity which does not properly belong to me, and consequently feel that I should further add that the new system of cup and gutters devised by me has been patented, as it was devised by me before entering the service of the Bureau of Forestry; but the bureau, while recognizing my personal right to the patent, deems it improper for me to receive any royalty on the patent so long as I am officially connected with the bureau.

CHARLES H. HERTY.

Jacksonville, Fla., March 9, 1904.

The Latitudes of Greater New York.

The Greater New York extends through 14 minutes and about 45 seconds of latitude and 28 minutes and about 30 seconds of longitude. The extreme southwestern cape of Staten Island, which is the most southerly point of the city, lies almost exactly 40 degrees, 30 minutes, and 15 seconds north of the equator. The junction of the city line with the Hudson River on the edge of Yonkers, which is the most northerly point of the city, lies almost exactly 40 degrees, 54 minutes, and 55 seconds north of the equator. The western edge of Staten Island marks the most westerly point of the city. It is as nearly as may be 74 degrees, 15 minutes, and 30 seconds west from Greenwich, while the extremity of City Island, which is the most easterly point of the city, lies almost exactly 73 degrees and 47 minutes west from Greenwich.

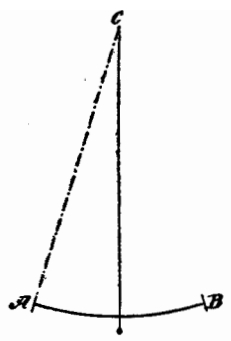
The difference in latitude between the extremes of the city, taken with the difference in elevation and the presence of the sea in the southern part, makes an appreciable difference in climate. There is decidedly more snow and a somewhat lower average winter temperature on the edge of Yonkers than at the southwestern extremity of Staten Island. While the highest point of the city is the ridge near the center of Staten Island, where the elevation at several points exceeds 400 feet above sea level, the general elevation in the upper portion of the city is considerably greater than that of the parts south of Central Park. The highest point on the island of Manhattan is on the wooded ridge overlooking the Hudson at a point nearly due west of Washington Bridge, where the elevation is nearly 260 feet above sea level. A little further north the island reaches a height varying from 180 to 240 feet. The vegetation on this elevated ridge shows the influence of the height above sea level. It suggests the vegetation of the Palisades. The elevations of the Bronx reach 180 and 200 feet in Van Cortlandt Park and in parts immediately southwest of the park. The highest elevation in Bronx Park is just short of 150 feet, and of Pelham Bay Park, about 120 feet.

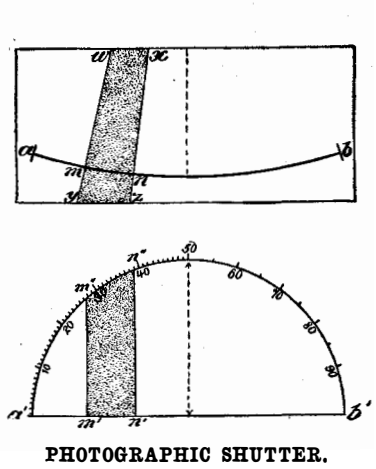
The coolest summer climate of the city is probably the central ridge of Staten Island, where, in the region which is intended for part of the proposed Richmond County park system, the greatest height is 413 feet above sea level. With a stiff sea breeze blowing, these heights are deliciously cool in midsummer. The valleys of the Borough of the Bronx are extremely hot in summer, though the heights are cooler than the built-up portion of the city down town. The narrow strip along the Hudson at the base of the high ridge of the island is one of the hottest parts of the city on summer afternoons, when the sun strikes from the west against the slope of the ridge and is reflected from the burnished mirror of the river.

The lower part of Manhattan and the boroughs of Brooklyn, Queens, and Richmond have rather more rain than the Borough of the Bronx. It snows occasionally in the upper part of the Bronx when only rain falls in the lower part of the city, and snow lies often for days and sometimes for weeks upon elevated parts of the Bronx after it has utterly disappeared from the parts of the city immediately bordering upon the harbor.—N. Y. Times.

METHOD OF TIMING PHOTOGRAPHIC SHUTTERS.

One of the simplest and most practical methods for determining the speed of a photographic shutter is that which has been lately devised by M. L. Pelleport, a French photographer. A nail is driven in the wall at *C*, and from this hangs a pendulum formed of a ball on the end of a string, which should swing freely near the wall. The arc, *AB*, is traced, with *C* as a center, by holding a piece of chalk against the cord, and the limits of the arc, *A* and *B*, are clearly defined by a short mark. The camera is focused upon the arc, *AB*, so as to have as large an image as possible, excluding the point, *C*. The pendulum is drawn to one end of the arc and then allowed to swing, the shutter being opened at the same moment. The photograph appears somewhat as in the second diagram, showing the arc, *ab*, and a grayish band, *wxyz*, the image of the successive positions occupied by the pendulum during the time the shutter is open. A straight line, *a'b'*, is drawn, having the same length as the arc, *ab*, and upon it is erected a half-circle, which is divided





PHOTOGRAPHIC SHUTTER.

into a certain number of parts, say 100. On the base line lay off the distances, $a'm'=am$ and $a'n'=an$, and erect the perpendiculars, $m'm''$ and $n'n''$. The number of divisions in the arc, $m''n''$, compared with the whole number on the semi-circumference, shows what fraction of the length of the pendulum's oscillation the shutter has remained open. To find the time, it is only necessary to know the time of oscillation, which is deduced from the length of the pendulum. For convenience, a second's pendulum may be used. The method, depending upon the physical formula, $\sqrt{\frac{e}{g}}$ is only strictly correct for infinitely small oscillations, but gives a close enough approximation for ordinary use.

The international cup race for motor boats, to be held on July 30, will be participated in by representatives of the United States, England, and France. America has two entries. England and France have more than the allotted three, and will hold elimination trials. S. F. Edge has two launches under way for the English trials. They will be made of bronze. One is forty feet in length and will be equipped with a 120-horse-power engine. The other is thirty-five feet in length with proportionate horse-power. Another English entry is that of Lord Howard de Walden, a wealthy peer and enthusiastic automobilist. France has entered a boat of 150 horse-power of the Gardiner-Serpollet type. Steam will be the motive power of this. The displacement will be twice that of the other boats. On this account the powerful craft may not stand much show. Another French entry is that of G. Peter, a builder of motor boats, regarding which no particulars are given.

Electrical Notes.

An experiment performed by Dr. A. Ludwig has demonstrated the possibility of melting carbon and maintaining it in the liquid condition. The heating was effected under great pressure in the electric furnace, and a curious phenomenon noticed at 1,500 atmospheres was that after a brief failure of the arc, the current refused to pass even when the voltage was much increased. It is supposed that as the carbon passed into the liquid and transparent state, it assumed a rare allotropic form, becoming a non-conductor. The test was too brief for a study of this condition, but was made to include a sudden cooling of the molten carbon by a flooding with water of the interior of the pressure vessel. Though minute diamonds were recognized in the gray powder thus obtained, the result was not wholly satisfactory.

Shortly after the Paris disaster, a commission was appointed for taking such precautions as would be likely to increase the safety of service on the Berlin underground railway. These precautions have now for the greater part been carried out. The lighting circuit of the tunnel has been enlarged by additional independent wires, enabling, in the case of one half of the lamps being injured, the second half to go on burning. The ticket boxes on the underground railway stations are so designed as to be readily pushed aside. The number of fire hydrants has been increased, and each car has been fitted with a sand box. There are bucket fire extinguishers in each car, as well as in the tunnel at distances apart of 328 feet. Each station has been connected to the fire brigade alarm line. The emergency lamps in the cars are prevented from any contact with the curtains, the latter being, moreover, of a heavy, impregnated, wool stuff. Each motorman's stand is provided with short-circuiting devices which may be operated from within the car, and made to cut the current off the line.

Cost of water-power development depends, in large measure, on the location of the electric station that is to be operated. The form of such a station, its cost, and the type of generating apparatus to be employed are also much influenced by the site selected for it. This site may be exactly at, or far removed from, the point where water that is to pass through the wheels is diverted from its natural course. A unique example of a location of the former kind is to be found near Burlington, Vt., where the electric station is itself a dam, being built entirely across the natural bed of one arm of the Winooski River at a point where an island near its center divides the stream into two parts. The river at this point has cut its way down through solid rock, leaving perpendicular walls on either side. Up from the ledge that forms the bed of the stream, and into the rocky walls, the power station, about 110 feet long, is built. The up-stream wall of this station is built after the fashion of a dam, and is reinforced by the down-stream wall, and the water flows directly through the power station by way of the wheels. A construction of this sort is all that could well be attained in the way of economy, there being neither canal nor long penstocks, and only one wall of a power house apart from the dam. On the other hand, the location of a station directly across the bed of a river in this way makes it impossible to protect the machinery if the up-stream wall, which acts as the dam, should ever give way. The peculiar natural conditions favorable to the construction just considered are seldom found.—A. D. Adams in Cassier's Magazine.

The Current Supplement.

The current SUPPLEMENT, No. 1475, opens with an instructive article by Mr. Randolph I. Geare, describing the Smithsonian exhibits for the St. Louis Exposition. It is the purpose of the Editor to publish in the SUPPLEMENT what may well be considered a manual of radium technology, to run through three numbers. The first installment of the paper appears in the current SUPPLEMENT. Mr. Harlan I. Smith discusses in an interesting way the methods of collecting anthropological material. "A Chat About Spoons" is the title of an article that gives many a curious bit of information. Of interest to electricians are articles on the electrolytic refining of lead, the first electric trunk railroad in Great Britain, and the magneto-elastic detector. Mr. H. M. Riseley writes on "Electricity and Mule Power on Canals."

It is said that the Pullman Palace Car Company is about to introduce a sleeper which, from a sanitary standpoint, will be a considerable improvement over that hitherto used on the railroads of the country. The new standard is severely plain and is devoid of all scroll and grill work. The upholstery of the car has been reduced materially and all the angles possible have been taken from the car. Imported mohair has been adopted as a standard curtain and the entire design of the decoration and furnishing is planned with a view to minimizing the work of cleaning the car and preventing the lodgment of germs.

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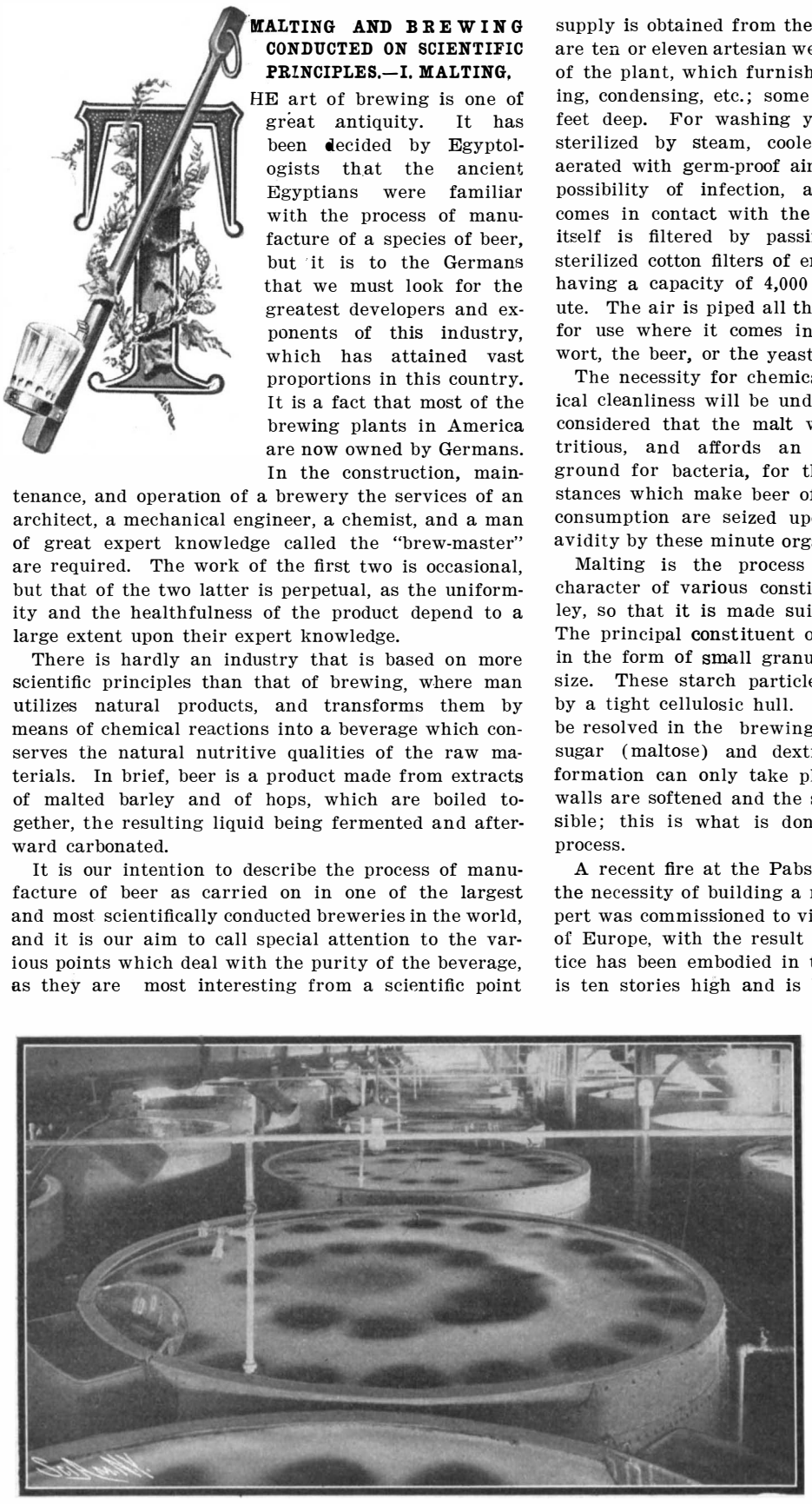
MALTING AND BREWING CONDUCTED ON SCIENTIFIC PRINCIPLES.—I. MALTING.

THE art of brewing is one of great antiquity. It has been decided by Egyptologists that the ancient Egyptians were familiar with the process of manufacture of a species of beer, but it is to the Germans that we must look for the greatest developers and exponents of this industry, which has attained vast proportions in this country. It is a fact that most of the brewing plants in America are now owned by Germans. In the construction, maintenance, and operation of a brewery the services of an architect, a mechanical engineer, a chemist, and a man of great expert knowledge called the "brew-master" are required. The work of the first two is occasional, but that of the two latter is perpetual, as the uniformity and the healthfulness of the product depend to a large extent upon their expert knowledge.

There is hardly an industry that is based on more scientific principles than that of brewing, where man utilizes natural products, and transforms them by means of chemical reactions into a beverage which conserves the natural nutritive qualities of the raw materials. In brief, beer is a product made from extracts of malted barley and of hops, which are boiled together, the resulting liquid being fermented and afterward carbonated.

It is our intention to describe the process of manufacture of beer as carried on in one of the largest and most scientifically conducted breweries in the world, and it is our aim to call special attention to the various points which deal with the purity of the beverage, as they are most interesting from a scientific point of view, especially when the enormous quantity of raw materials consumed and the beer produced are considered.



Steeping and Aerating the Grain.

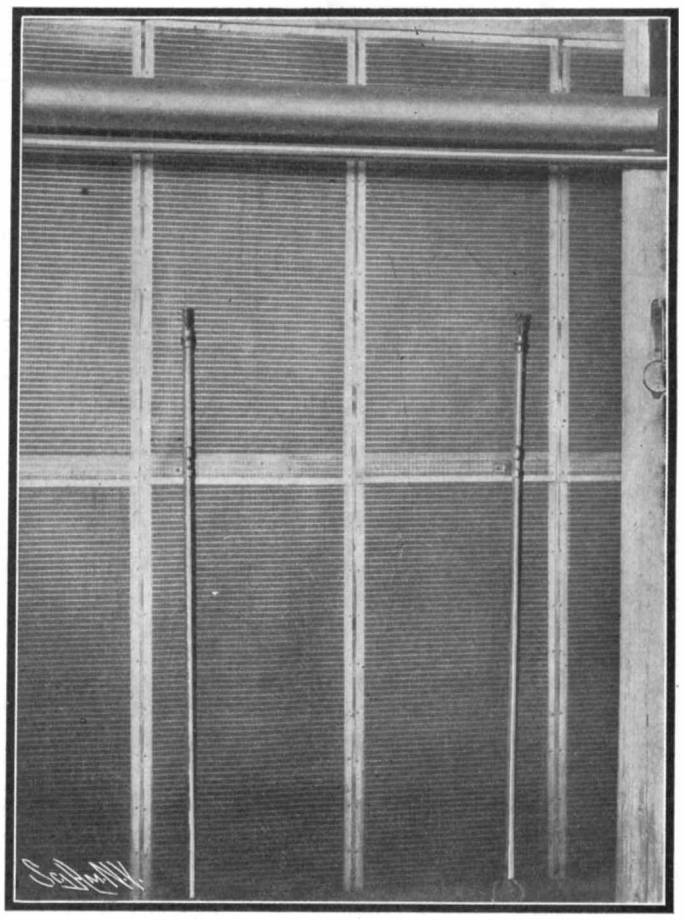
As we have already said, malted barley and hops are the basis of beer. More than 1,500,000 bushels of barley are consumed annually in the Pabst Brewery at Milwaukee. The barley comes from Wisconsin, Minnesota, Iowa, Dakota, and Montana, the latter State producing the best quality of grain. The cost varies from 60 to 75 cents a bushel, so that this is a very considerable item of expense. About 1,000,000 pounds of hops are also used, and come from California, Oregon, Washington, and New York States, from Bavaria and Bohemia. The domestic hops cost about 32 cents a pound, while the imported cost from 70 to 80 cents a pound.

The hops are stored in a special building, which has a storage capacity of 1,000,000 pounds. The temperature is kept at the freezing point by cold storage; this saves the volatile constituents, and retains the flavor of the hop. The barley is stored in elevators when it arrives, and it is taken through grading machines, where all impurities, such as sand, chaff, broken kernels, wheat, oats, etc., are removed and the grain is dusted. In order not to impair the quality of the grain during the time of storing, the barley is given frequent air baths by aerating and spouting; this prevents a spontaneous heating, and serves to cool and keep the grain in such a healthy condition that all danger of deterioration is eliminated. The grains should be also uniform in size, as this will insure a uniform germination during the malting process. We have now dealt briefly with two of the raw materials which enter into the composition of beer. There is one other which is also highly important—this is water. For malting and brewing, Lake Michigan water is particularly adapted, on account of its softness. The supply is obtained from the city mains. There are ten or eleven artesian wells in various parts of the plant, which furnish water for cleansing, condensing, etc.; some of them are 2,000 feet deep. For washing yeast the water is sterilized by steam, cooled, and afterward aerated with germ-proof air. To prevent any possibility of infection, all the air which comes in contact with the wort or the beer itself is filtered by passing through three sterilized cotton filters of enormous size, each having a capacity of 4,000 cubic feet a minute. The air is piped all through the brewery for use where it comes in contact with the wort, the beer, or the yeast.

The necessity for chemical and bacteriological cleanliness will be understood when it is considered that the malt wort is highly nutritious, and affords an excellent culture ground for bacteria, for the nutritious substances which make beer of value for human consumption are seized upon with the same avidity by these minute organisms.

Malting is the process of changing the character of various constituents of the barley, so that it is made suitable for brewing. The principal constituent of barley is starch in the form of small granules of microscopic size. These starch particles are surrounded by a tight cellulosic hull. The starch should be resolved in the brewing process into malt sugar (maltose) and dextrine. This transformation can only take place if these hard walls are softened and the starch made accessible; this is what is done by the malting process.

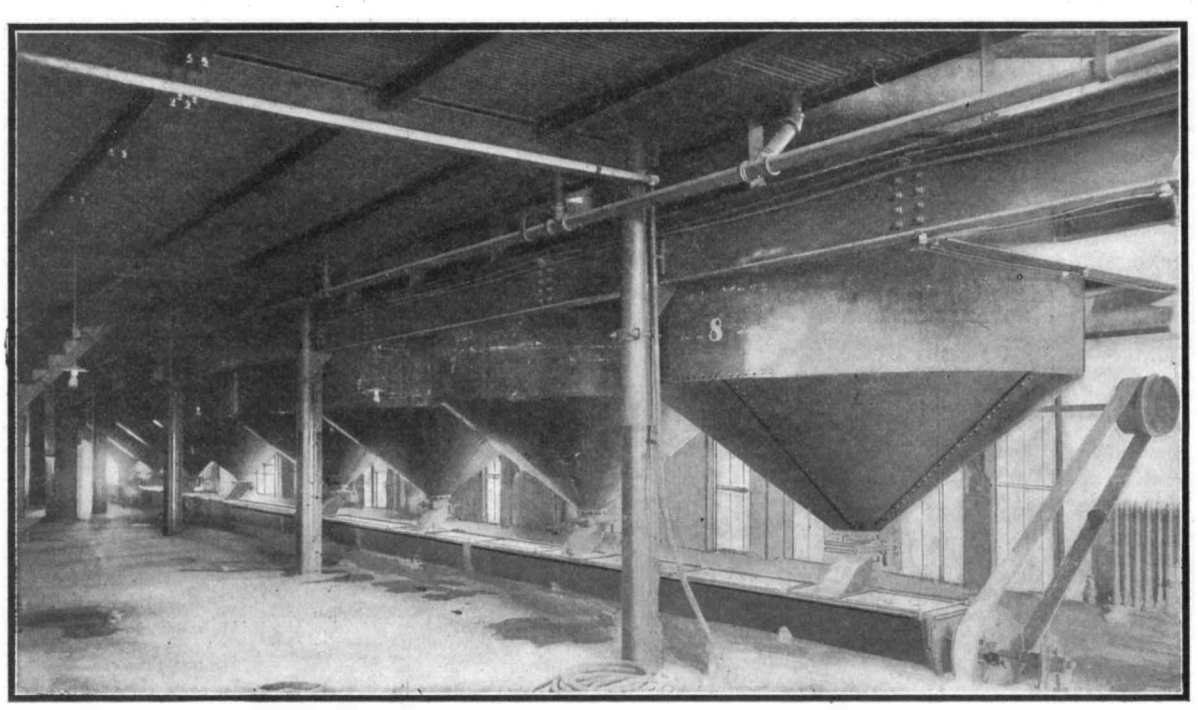
A recent fire at the Pabst plant occasioned the necessity of building a new malt house, and an expert was commissioned to visit the leading malt houses of Europe, with the result that the best foreign practice has been embodied in the new malt house, which is ten stories high and is built on the pneumatic, or Saladin system. The old plan was to lay the steeped barley on large cement floors, where it was manipulated manually by shoveling. This is still the prevailing system in most malt houses, and the drawbacks are obvious. There was in the old system no regularity in turning, aerating, cooling, etc., and it was necessary for the men to walk around in the wet grain, with heavy boots. The temperature of the malt was also dependent on the outside weather conditions, but in the pneumatic system you make your own weather with regard to temperature and humidity; in summer you cool the air, in winter you heat it. All of the windows are triple, to avoid the entrance of untreated air of an improper temperature and humidity, and even the entrances to the rooms are air-locked.



A Portion of an Air Filter, Showing Water Spray.

The barley is conveyed mechanically into large enameled steel steeping tanks, each containing 650 bushels. Water is added, and the steeping process occupies from fifty to sixty hours. During this period the kernel is gradually absorbing moisture; air is admitted from below in a finely-divided stream, for a two-fold purpose. The barley is washed, cleaned, and at the same time absorbs oxygen from the air, thus promoting the subsequent growth in the malting process.

The barley might be said to breathe while in storage, and we might almost say that the water asphyxiates the grains, but this aeration really maintains and enhances the normal functions of the grain for the malting process. After the steeping is completed, the grain is run down to compartments on the germinating floors. These compartments are 100 feet long, 11 feet wide, and 5 feet deep. The walls are lined with cement, and the floor is constructed of perforated metal, giving access to an air passage underneath the compartment. The steeped barley is laid to a depth of two feet on this perforated floor, and then allowed to sprout. This operation is accompanied by the evolution of heat, which must be regulated within narrow bounds; 60 deg. F. is the upper limit, and 48 deg. F. is the lower limit. Thermometers are used to ascertain the temperature. In order that the air may be kept normal at all times, it is introduced to the germinating floors through an attemperating room of enormous size. In this chamber are vertical zinc plates, 150 feet long and 9 feet high, and there are fourteeen series of such plates. They are perforated, to allow the air to pass through them. In front of each series there are a hundred sprays, which finely divide the water, which is thrown against the perforated plates and flows down the whole series, thereby



Bottom of Steeping Tanks, Showing Conveyors for the Wet Grain.

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washing the air in its tortuous passage through the filter, removing all dirt and floating organisms. Radiators at the air inlet serve to furnish heat if required, and a refrigerating room at the other end of the attemperator serves to reduce the temperature when necessary. Two large suction-fans throwing 2,000 cubic feet a minute draw the tempered and purified air through large flues to the various germinating floors, and it is only to this air that the barley is exposed.

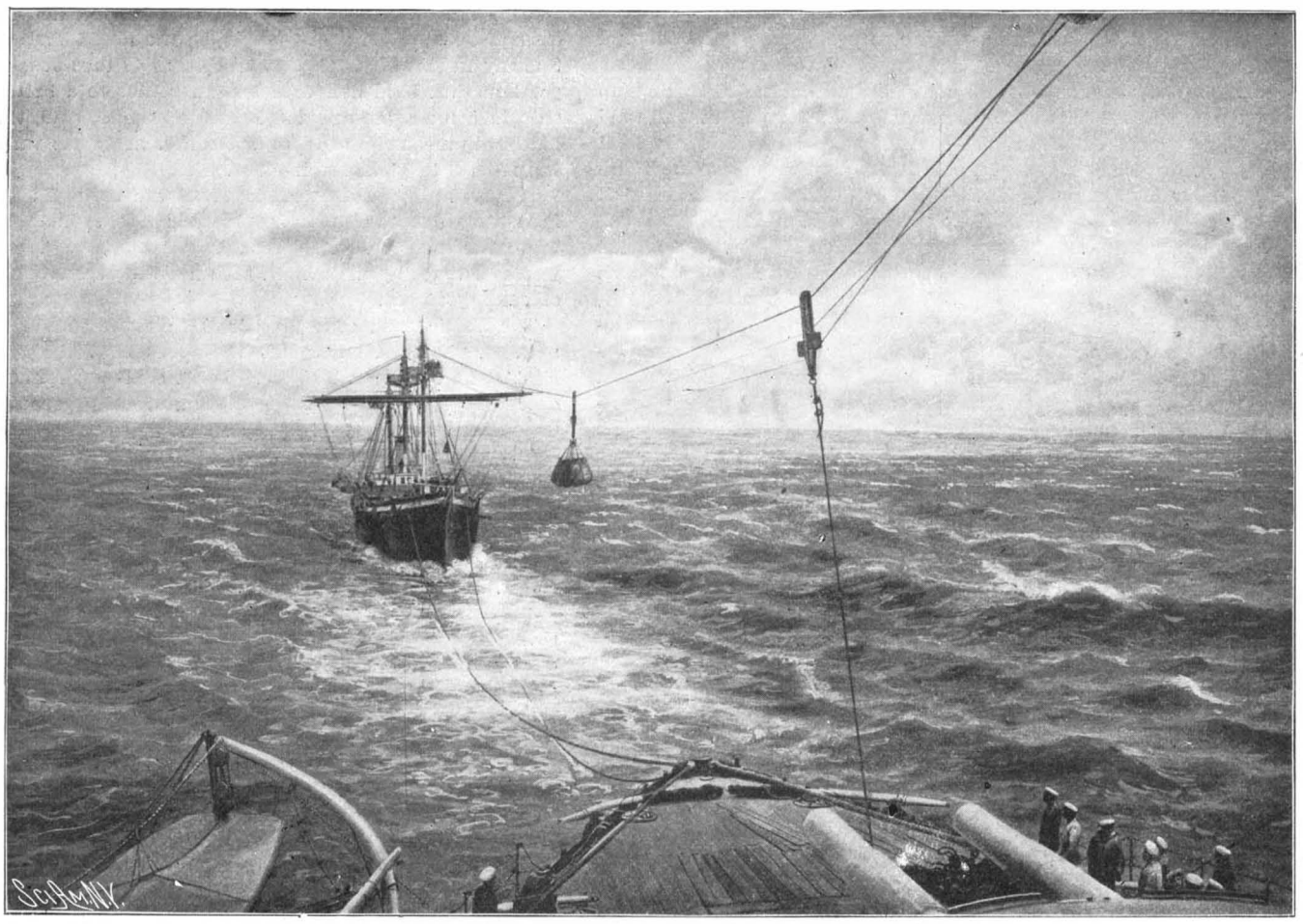
Now, if the heat of the steeping grain reaches the danger limit, a valve underneath the perforated floor is opened, and the air is drawn through the grain by means of the exhaust fans, an equitable temperature thus being maintained. The grain is turned from time to time by a mechanical turner, which, while turning the grain, travels back and forth the length of the compartments. This serves to bring to the surface a new stratum of grain. The sprouting process occupies eight days, and at the end of this time the grains have ceased to be encysted by the hard walls, and the starch can be attacked in the mashing tubs in the brew house. The operation of malting is completed by drying the sprouted barley in kilns, which are large perforated metal floors, through which heated air is drawn by large exhaust fans. The kiln consists of four floors, and the green malt is introduced on the top floor, and gradually descends from floor to floor by gravity, the dumping taking place by the operation of shutters, which constitute the floors and which can be manipulated from outside. As the grain drops from floor to floor, the heat becomes greater and greater, until the barley can be compared to a baked loaf of bread. It is as tender as a cracker, and it has a pleasant aroma. The drying takes about forty-eight hours. To insure the specific character of the malt for various beers, the kilning is conducted in two stages. The malt is then cleansed, and the sprouts removed by shaking in machines, and is stored in dust and moisture proof bins, where it is held in reserve for use in the brew house.

In a subsequent article we will treat the process of brewing.

Germany's pavilion at the World's Fair is under roof. The building is a replica of the castle at Charlottenburg. The plans were revised by Emperor William.

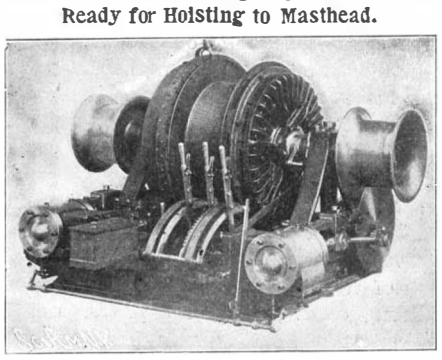
RUSSIA'S LAST HOPE ON THE SEA.

Things are in a pretty bad way with the Russian fleet in the Far East. About as bad, indeed, as they could possibly be. Unless the genius of Makaroff can devise some brilliant strategy that will render the still formidable remnant of the Czar's ships effective, it does not take the eye of an expert to foresee the inevitable catastrophe. As the result of the inexplicable carelessness or lack of forethought of Alexieff, the opening of the war found the armored fleet of Russia divided by about a thousand miles, the armored cruisers being at Vladivostock and the battleships at Port Arthur. The strength of the battleship division was reduced, as we all know, by the Japanese night attack until it was hopelessly inferior to the blockading fleet. For either the Port Arthur or Vladivostock fleet to come out and engage the enemy, would be nothing better than a forlorn hope—so greatly are they now overmatched. At the same time, the mining of the harbors makes it out of the question for the Japanese to enter. For the present the plan of the naval campaign, as far as Japan is concerned, is to maintain the blockade of the two ports so closely, that neither squadron can emerge without being forced to

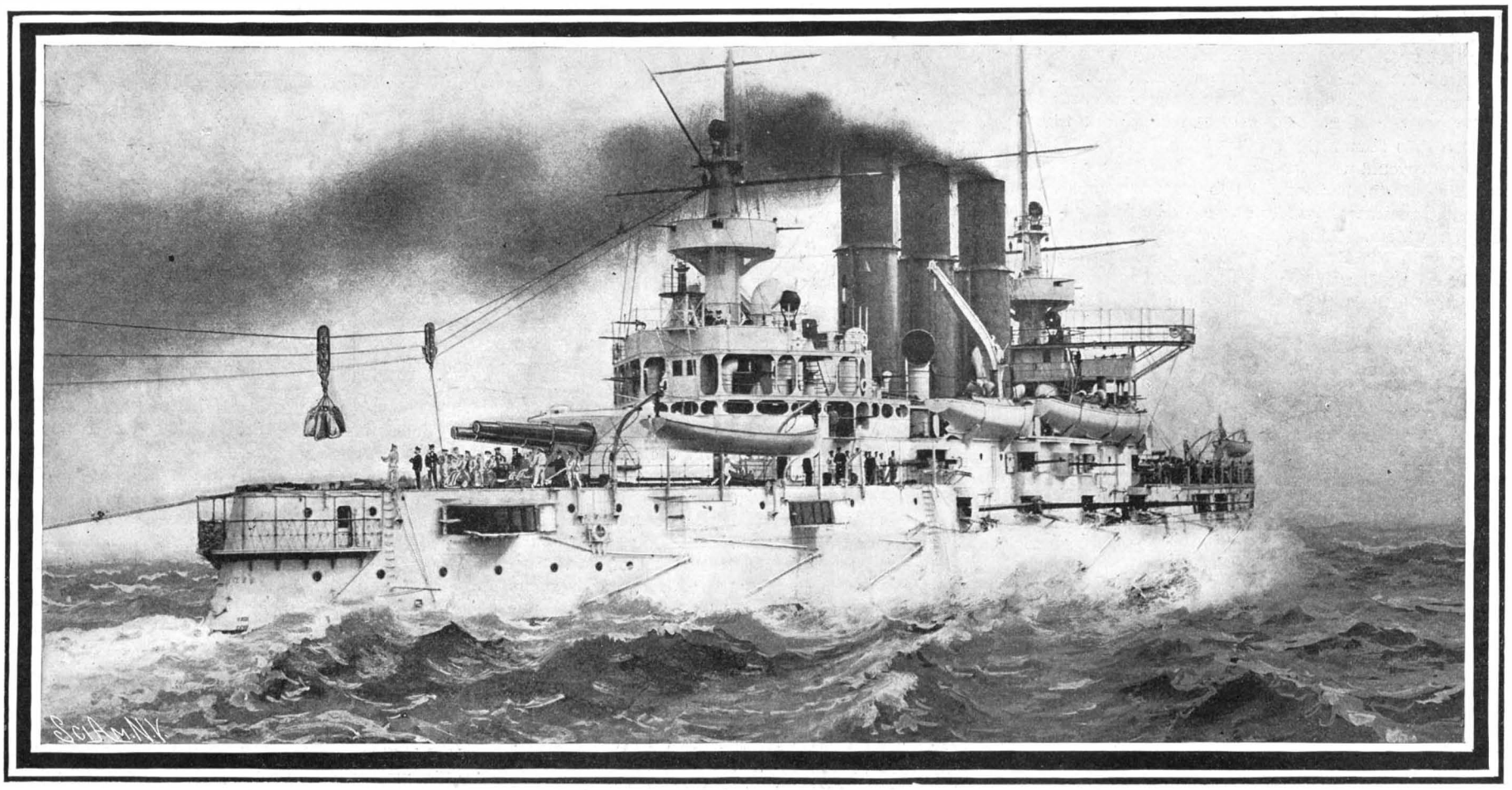


Looking Aft from a Warship Coaling from a Collier Towed Astern.

Elevating Truck Loading Bags on the Deck, Ready for Hoisting to Masthead.



Cableway Winches.



The "Retvizan" While on Her Way to the Far East Coaling from a Collier Which She is Towing Astern.

COALING WARSHIPS AT SEA.

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give battle, and at the same time endeavor by a long-range bombardment to destroy the fortifications and, if possible, shell the ships as they lie in the harbor.

Notwithstanding the many reports as to the havoc wrought by Japanese heavy guns on Port Arthur's fortifications, we doubt if any serious injury has been done. The modern method of mounting coast defense guns *en barbette*, or on disappearing carriages behind massive concrete protection, renders the chance of dismounting guns exceedingly remote. The shelter for the gun detachments also is such that fatalities should be very rare; and unless the Russians have been remiss in laying in stores of ammunition and food, Port Arthur's forts should be able to withstand these bombardments for many months. What the chances would be of taking the place by combined sea and land attack is another question, which can only be answered by those who are fully conversant with the conditions. All things considered, it is probable that both at Port Arthur and Vladivostock, the effective remnants of the Russian armored fleet, consisting of probably five battleships and four armored cruisers, can remain in comparative safety under the protection of the forts and the submarine mines for many months to come. At Port Arthur the ships will, of course, be exposed to the chance of being hit by the plunging fire of long-range bombardment; but such individual hits will be more a matter of "luck than good shooting," and in spite of reports to the contrary, we are inclined to think that they are extremely rare.

Evidently, then, if any relief is to come to Russia in her naval campaign, it must come from without. In other words, the only hope of saving her Far Eastern fleet is for Russia to dispatch a second fleet to the rescue, which, by its approach, will raise the blockade, release the fleet now contained in Port Arthur, and reverse the situation by obliging the Japanese admiral to fight against a fleet numerically more powerful than his own.

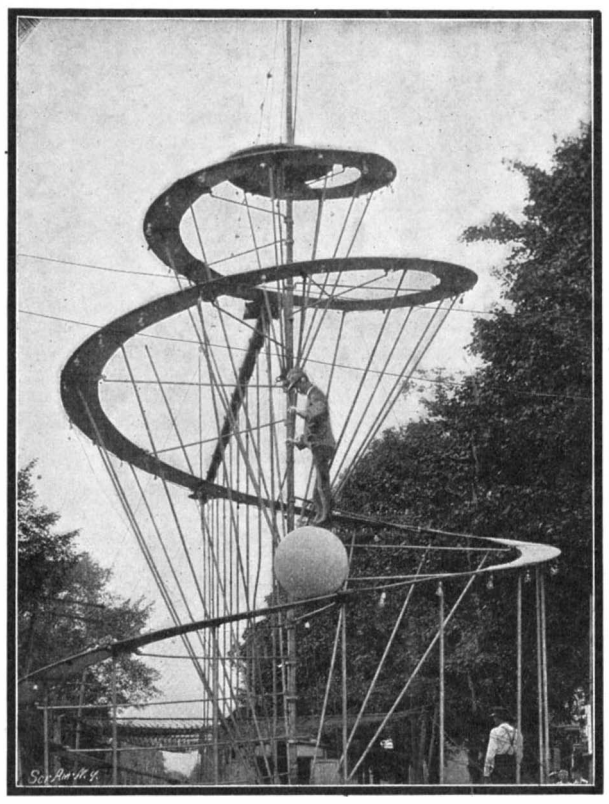
That Russia will bend every nerve to save the naval situation is morally certain; for the loss of her fleet in the Pacific would have a far wider significance than the disastrous effect it would have upon the Eastern campaign. It would mean the absolute extinction of the very flower of her navy, including seven of the best of her battleships, all of her modern armored cruisers, eight protected cruisers, including the best and latest of that type in her navy, and a fleet of thirty or more destroyers and torpedo boats, the loss representing a total value of not far short of $100,000,000. Now, it is a fact that these vessels represent the very cream of her navy; and it is no exaggeration to say that by such a disaster, the Russian navy would be reduced, temporarily at least, to second rate. Moreover, because of the slowness of warship construction and its great cost, coupled with the long lead that would be thus secured by rival nations, it is probable that Russia would never again regain her former position. Henceforth, her interests in Europe would demand that new accessions to her navy be retained in European waters. Thus would her dreams of naval supremacy in the Far East be dispelled for many a decade to come, if not, in view of Japan's ascendancy, for good. With these considerations in mind, it will be understood that by the Russian official mind in St. Petersburg and, indeed, by all farseeing and intelligent Russians, it is realized that some supreme effort must be made to rescue the beleaguered fleets, and avert the impending disaster.

Is there any such relief in sight? There is; and it is to be found in the five very effective and powerful warships known as the "Borodino" class, some of which must be by this time in commission and others nearing completion in the Baltic yards. If these five ships can be commissioned and dispatched to Port Arthur during the present summer, picking up the battleship "Osliabia" in the Mediterranean, it is possible that they might reach Port Arthur by the early fall in time to raise the siege.

The excellent qualities of this fleet, both for defense and offense, coupled with the fact that the vessels are of the latest design and are exactly identical, would render it, with the help of the "Osliabia," practically a match for the fleet of six battleships of Admiral Togo, which latter would by the autumn surely be feeling the stress of an unbroken war service of eight or nine months' duration.

Let us look once more at the character of these vessels. On a displacement of 13,566 tons they are designed to mount a main armament of either four 12.4-inch or of four 12-inch guns. The former is a new piece of great power, which these vessels are to carry if it is ready for them. These guns will be mounted in 11-inch-armor turrets. The intermediate battery consists of twelve 45-caliber, 6-inch guns, carried in 6-inch-armor turrets, while the secondary battery is made up of twenty 3-inch rapid-firers of the extraordinary length of 60 calibers, with corresponding increase in range and flatness of trajectory; twenty 3-pounders and eight 1-pounders. They carry two broadside submerged torpedo tubes and two above-water tubes, one in the bow, another in the stern, each protected by Krupp armor. The defensive qualities are finer, we think, than those of any ship afloat. They consist of a 9-inch belt tapered to 4 inches and 2½ inches at the ends; a secondary belt of 6-inch armor above the main belt, extending like the main belt entirely around the ship, and two protective decks, the lower one at the level of the top of the main armor belt, and an upper armored deck 2 inches in thickness at the level of the top of the upper armor belt. The space between these two decks is filled amidships entirely with coal. Furthermore, as a protection against waterline armor-piercing shell fire, and against torpedo attack below the waterline, a vertical wall or bulkhead of 4-inch armor extends longitudinally from the bow to the stern, at a distance of about 6 feet inboard from the sides of the ship. Add to this that the bases of the gun turrets, and the armored tubes leading up to the same, are armored with from 10 inches to 5 inches of Krupp steel, and it will be seen why the total amount of armor worked into a vessel of the moderate displacement of 13,566 tons reaches the high total of 4,000 tons. Of the five ships, the "Borodino," "Orel," and "Imperator Alexander III." were launched in 1901, and are undoubtedly completed by this time. The "Slava" and "Suvaroff" were launched in 1903, and twelve months ago were announced as to be completed in the present year. It is probable that in view of the coming Eastern complications, work has been rushed on these vessels, and that everything is working in the Baltic yards at high pressure to complete them. It is quite within reason to suppose that they will be ready, as announced in St. Petersburg, by the summer.

But even with the ships completed, there still remain the two serious questions of manning and coaling on the long journey to the Far East. The first would probably be accomplished by drafting the most experienced officers and men from the vessels of the Baltic and Black Sea fleets; and for giving them the necessary familiarity with the new ships, reliance would have to be placed upon the incessant drill in gun practice and maneuvers, which the fleet would undergo on the long journey to the seat of war. The problem of coaling is not so difficult a one as is popularly supposed. The successful introduction of the apparatus for coaling at sea, which is shown in the accompanying illustrations, in the Russian navy, has made it possible for an active fleet to carry its coaling stations with it, and coal up while under way at any time that it pleases, except, of course, in the heaviest weather. That this is contemplated by the Russian Admiralty is proved by a very significant dispatch which appeared recently in the daily press, to the effect that five vessels of the volunteer fleet (transport ships) have received orders to proceed to the Baltic, where they will be put in condition to serve as colliers for the Baltic squadron, which is to sail for the Far East in June. It is noteworthy that the number of vessels coincides with that of the five vessels now building. Now the latest and largest of the vessels of this volunteer fleet are of from 9,000 to nearly 12,000 tons displacement, with speeds of 19 to 20 knots an hour. By making the necessary structural alterations, these ships would be able to load up with 25,000 to 30,000 tons of coal, and with their good speed they would easily be able to keep up with the fleet of new battleships (all of which can do 18 knots) at a cruising speed of, say, as high as 15 knots an hour. The fleet would be fitted with the apparatus for coaling ships of war at sea, which is shown in the accompanying illustrations, which represent the Russian battleship "Retvizan" when she was taking coal while under way. The method of operation, briefly stated, is as follows: The collier is towed astern of the battleship, and an overhead cable is stretched from the after mast of the battleship to the foremast of the collier, on which is a traveler provided with hooks to which the buckets of coal are attached. Arrangements are provided for taking up the slack of the cable or paying out, as the distance between the ships varies in the seaway. The full buckets are hauled from the collier, and the empty buckets returned in the same manner as the ordinary overhead cable conveyer is operated in excavation work, as seen recently on the Rapid Transit Subway in this city. As much as 35 to 40 tons of coal per hour has been delivered from a collier to a battleship in a moderate sea and a heavy gale of wind, the battleship meanwhile towing the collier at speeds varying from 8 to 11 knots an hour.



AN INTERESTING BALANCING FEAT.

It would also be possible to adopt the method used in taking out the monitor "Monadnock" to Manila, when the monitor, with fires banked, was towed the whole distance by the collier, thus avoiding the trouble of coaling at sea.

The Baltic fleet, conveying its own coaling stations with it, should easily make the passage to the Far East at an average speed of 15 knots an hour; for our own "Oregon," a 16-knot vessel, made the trip around Cape Horn at about 14 knots an hour, and the new Baltic ships, as we have said, are 18-knot vessels. If the fleet is able to get away, as announced, in June, it should reach the Far East by August. If, on the arrival of the fleet, Port Arthur and Vladivostock are still holding out, the naval war will take on an interest, for which it will be scarcely possible to find a parallel in naval history. Will Admiral Togo, realizing that the approaching fleet is more powerful than the one which he has been blockading these many months, gather his eight armored cruisers before Port Arthur, and go with his battleships and destroyers to meet the Baltic fleet; or will he dispatch his torpedo fleet, bidding his captains risk everything in a desperate night attack in the open? Or will Makaroff make the first move by a determined dash from Port Arthur, to effect a junction with the relieving force? Should a junction be made, Russia would have eleven battleships against Japan's six.

It is evident that, as far as Russia is concerned, the fate of Russia's navy depends upon the ability of Makaroff to hold Port Arthur for the next few months. Should it fail and the blockaded battleships be destroyed, there would be nothing left for the Baltic fleet but a prompt return to European waters; for without the naval bases of Port Arthur and Vladivostock to fall back upon, it would be merely a question of time before this fleet would be run down and overpowered by the victorious enemy.

AN INTERESTING BALANCING FEAT.

An interesting feat in equilibration is performed by William Sprengel, a Western cowboy. Upon a spiral tower with a runway 160 feet in length and 16 inches wide he ascends and descends, standing upon a large wooden ball. This ball he rolls with his feet, keeping it in the center of the runway. The runway is veneered wood and perfectly flat. The greatest incline is 4½ feet in 20. The ball is 28 inches in diameter and weighs 80 pounds. In ascending, Mr. Sprengel is said to be pulling 150 to 160 pounds, and in coming down is holding back from 75 to 80 pounds. After reaching the top of the tower, before descending, he rolls the ball out and back upon a perfectly flat imitation cable 50 feet in length. At all times his eyes are kept steadily upon the ball. Ten minutes are required to make the entire trip up the tower, out on the cable, and back to the ground. The feat has also been performed in Europe and in Cuba by Achille Philion, the originator of the act and the owner of the paraphernalia. Sprengel is his successor, and has been doing the act about a year.—W. Frank McClure.

The Problem of Columbus.

H. W. Chapman in Phil. Mag. determines completely the motion of an egg-shaped body (symmetrical about an axis and with a hemispherical end) on a perfectly rough horizontal plane. The results show: (1) That the axis of an egg-shaped body would not rise toward the vertical unless, when its axis is horizontal, it receives not only a spin about the vertical, but also a rolling motion round its axis; (2) that even when so spun, it is very improbable that its axis would rise to the vertical. The rising observed in the case of smooth wooden eggs is connected with the phenomenon of limiting friction, and a rough cement egg rose only with difficulty, and usually remained oscillating between two cones, as required by the theory for a perfectly rough egg.

A canal is to be cut between Lake Onega and the White Sea at the estimated cost of 12 million rubles.

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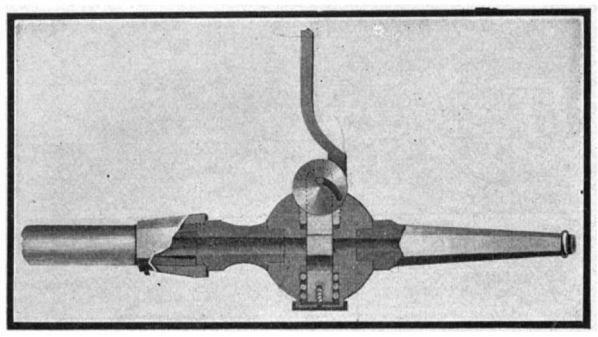
Patent Department

IMPROVED HOSE-NOZZLE.

In the accompanying illustration we show an improved form of hose-nozzle invented by Mr. Charles L. Sankey, of Engine Company 7, Yonkers, N. Y. This hose-nozzle is so constructed that the plug of the valve will be operated by a cam lever arranged to bring the waterway or passage opening in the plug in registry with the water passage in the body of the nozzle, and to admit the waterway of the plug to be automatically carried out of such registry. The cam lever is also so arranged that it will remain in either position in

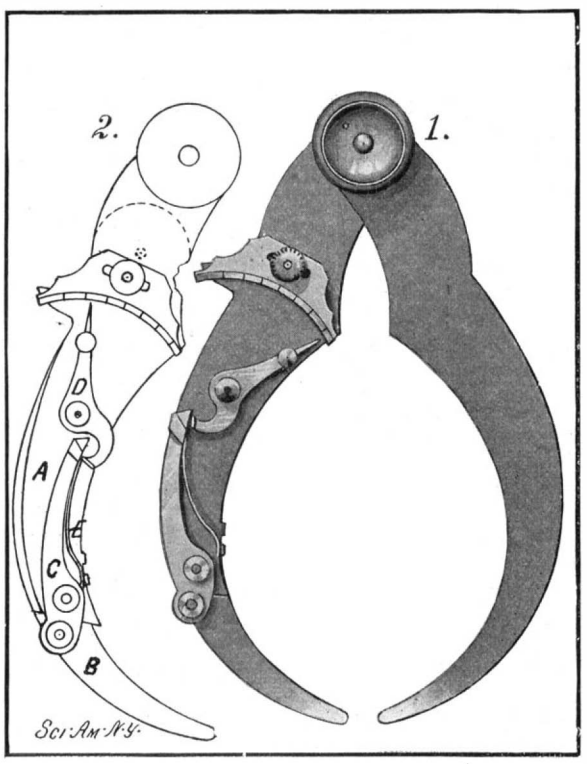


IMPROVED HOSE-NOZZLE.

which it is placed until purposely moved, enabling the nozzle to be set for the free delivery of the water for an indefinite period of time without attention, or the supply of water to the tip of the nozzle to be conveniently and instantly shut off when desired. As shown in our illustration, the tip and the neck of the nozzle are threaded into opposite sides of the spherical body portion. The body of the nozzle is vertically traversed by a chamber in which the valve plug is adapted to slide. A coil spring bearing against a washer on the bottom of the plug serves to hold the plug normally in its lowest position. At its upper end the plug is slotted to receive a cam, which is also seated in a groove in the top of the body of the nozzle. The cam is held in place by a pin passing through a slot therein, and driven into the members of the bifurcated portion of the plug. The valve is operated by means of a handle, which projects from the cam. When it is desired to open the valve, the handle is turned to a horizontal position, and the plug is forced to rise by the pin acting in the cam slot, which brings the opening in the plug into registry with the bore in the body of the nozzle. Whenever it is desired to cut off the flow through the nozzle, it is simply necessary to throw the handle upward, when the spring will force the plug down to the position illustrated.

IMPROVED CALIPERS.

A patent has recently been granted to Mr. William A. McDonald, of Garfield, N. J., for an improvement in calipers which affords many advantages over the crude instruments now generally in use. The improved calipers can be used while the work in the lathe is running, without danger of altering the size set on the calipers, thus saving the time of stopping and starting the lathe, as would be necessary with other types of calipers. When set to the size wanted



IMPROVED CALIPERS.

the calipers may be made to indicate how much larger the piece is than desired without the size already set being changed. As illustrated herewith, one of the caliper arms is formed of two members, *A* and *B*, which are pivoted together near their upper ends. A lever *C* is pivoted to the lower end of arm *A* and also at its lower end to member *B*, while at its upper end it carries a flat spring *E* which presses against an ear on member *A*, thereby holding the member *B* in the normal position indicated in Fig. 1. When in this position the member *B* presses against the stop formed on the inner edge of the member *A*. A pointer lever *D* is also pivoted to the member *A* in such position that it will be engaged by the upper end of the lever *C*. Whenever the member *B* is moved out of normal, as shown in Fig. 2, this pointer indicates on a scale the amount of this movement, and, due to the compound leverage, a movement at the caliper points will be multiplied about eight times on the scale, thus virtually supplying the calipers with a micrometer attachment. In use the points of the calipers are brought slightly closer together than the measure desired and the thumb screw on the main joint is screwed up as tightly as possible. Then, with the pointer moved into engagement with the lever *C*, the points are passed over the object which it is desired to measure. This will move the pointer slightly to the left and the adjustable scale is then set, bringing one of the marks on the scale in line with the index point. Now, in passing the points of the calipers over the work in the lathe, the index hand will show just how much larger the work is than desired by moving past the mark on the adjustable scale, or if the object is smaller than desired the index pointer, which had previously been set into engagement with the lever *C*, would not reach the mark set on the scale. In this way one can measure anything larger or smaller than the work desired and to a much finer degree of accuracy than with calipers now in use.

A Novel Life-Saving Boat.

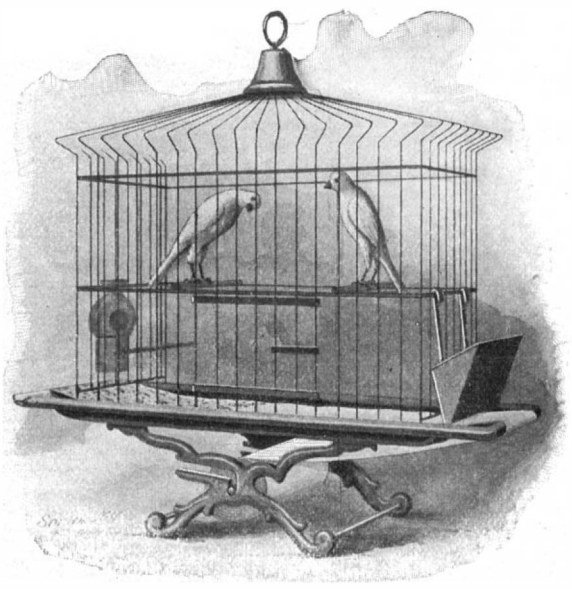
James Mitchell, Sr., of Arrow River, Manitoba, Canada, is the inventor of a novel life-saving boat, which has more than once been made the subject of a note in this journal. Mr. Mitchell sends us two certificates, issued by the Naval Assistant's office at Halifax, in which some interesting tests made with the lifeboat are described. In November, 1902, a lifeboat was built according to Mr. Mitchell's plans, which was made the subject of rigorous tests. She carried about 1,200 pounds of ballast in addition to five men on the thwarts; in the bottom of the boat. She was parbuckled over, and righted very quickly and satisfactorily. A boat, similar to this, was ordered by the Dominion government for the fishery protection cruiser "Acadia." She was tested without any ballast whatever, with only three men on board, who held on to the thwarts. When parbuckled over, she righted at once. The Naval Assistant gave it as his opinion that the Mitchell lifeboat was thoroughly self-righting without ballast. Admiral Rivet, of the French flagship "Tage," made a test on July 28, 1903, on which occasion the boat was launched from a wharf 14 feet 6 inches above the tide level. The boat took the water end-on with a crew in her, was immersed about one-third of her length, and then floated on an even keel.

WINDMILL WITH REVERSING ATTACHMENT.

We illustrate herewith a new type of windmill, which is so arranged that its direction of rotation may be reversed whenever desired. The shaft of the windwheel lies transversely across the path of the wind, and it carries a drum on which radial blades are arranged like the blades of a paddle-wheel. A shield which is placed to windward of the wheel serves to cover either the lower or upper half of the wheel, according to its position. This shield is supported by two ropes, each of which is secured at one end to the top of the shield, and at the other end to the bottom of the shield. The ropes pass over pulleys at the top and bottom of the shield frame, and also over two pulleys keyed to a shaft which lies directly under the windwheel. Loosely mounted on this shaft is a sleeve, to which rotary movement is imparted from the windwheel by means of belt and pulley connection therewith. This sleeve carries at one end a cone, which forms one member of the friction clutch, the other or cup member being secured to the pulley shaft. Now, with the shield in the lower position, the wind will strike the upper blades of the windwheel and, if it is desired to shift the position of the shield, a cord is pulled which, through the medium of a forked lever, as illustrated, throws the friction cone into engagement with the cup, thereby imparting rotary movement to the pulley shaft and drawing the shield to its upper position, when the wind will strike only the lower half of the wheel, thus reversing the direction of its rotation. Now, when next the cord is pulled, the pulley shaft will rotate in the opposite direction, drawing the shield to its lowest position. In operation, the instant the shield reaches the desired position, the operating cord is released, whereupon a spring, acting on the forked lever, will throw the clutch members out of engagement. At the same time another cord is pulled, which is connected to a brake band that encircles the cup member of the clutch. This serves to instantly stop the rotation of the pulley shaft. Mr. William A. Butler, of 927 Market Street, San Francisco, Cal., is the inventor of this windmill.

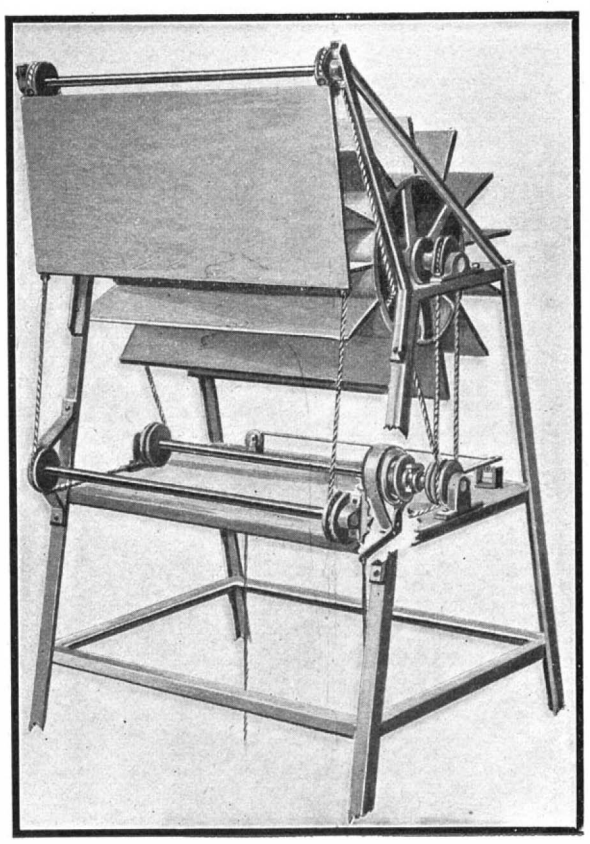
CONVENIENT ATTACHMENT FOR BIRD CAGES.

A recent invention provides a very convenient means of removing the paper in the bottom of a bird cage and replacing it with a new strip. The arrangement



CONVENIENT ATTACHMENT FOR BIRD CAGES.

is such that if desired the paper may be changed without removing the cage from its suspending hook. As shown in the accompanying illustration, the bird cage is provided with two downwardly-extending hangers, which also serve as legs for the support of the cage when it is placed on a table or the like. These hangers have inwardly-extending slots that terminate in depressions which form bearings for the spindles of a paper-roll holder. The paper from this roll extends over one edge of the cage and thence along the bottom of the cage to the opposite edge. At the point where the paper enters the cage a hopper is secured in which fine gravel is stored. When it is desired to change the paper in the cage the soiled strip is drawn out and torn off on the edge of the cage bottom, which is sharpened at this point. The fresh length of paper which is thus brought into the cage is covered with a thin layer of gravel which is fed out of a slot in the bottom of the hopper. Thus, by a single and very simple operation, the cage is cleaned and refitted with fresh paper and gravel. The hopper for gravel is held in place merely by two hooks, and can therefore be removed when desired. The paper holder also can be readily removed, owing to the slots which connect with the bearings. This affords a quick method of replacing the roll with a new one when the paper is exhausted. Mr. Joseph A. Quelch, of 331 Manhattan Avenue, Brooklyn, New York, is the inventor of this improved bird cage.



WINDMILL WITH REVERSING ATTACHMENT.

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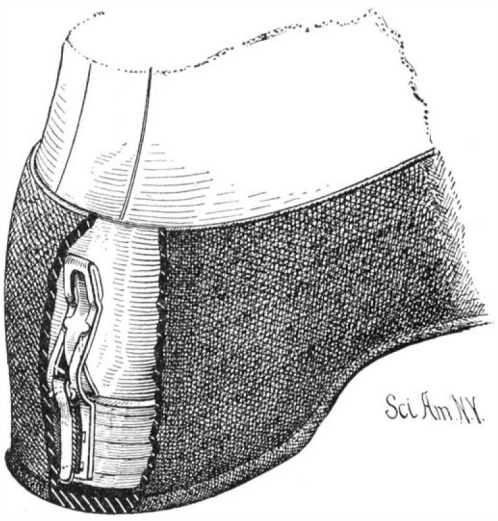
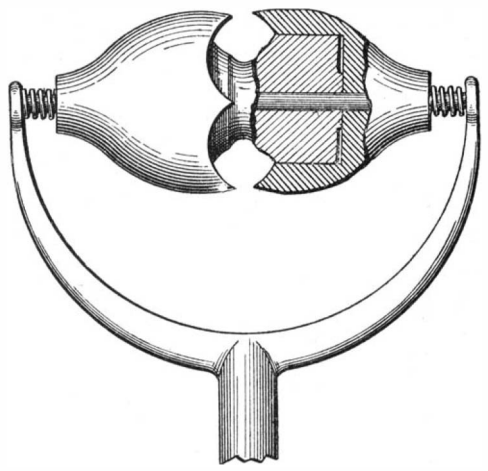
ODDITIES IN INVENTIONS.

Fastening Device for Overshoes.—Unless one's overshoes fit very snugly it is often quite difficult to keep them on the shoes when walking over muddy roads. As the same person often wears shoes which vary greatly in shape, it is sometimes impossible to find a single pair of rubbers which will fit them all snugly. The simple little clip which is shown in the accompanying illustration should therefore be found very useful to many people. It consists of a metal strip provided with a tongue which fits into a pocket formed at the heel of the rubber on the inner surface. The upper edge of this clip presses against the back of the overshoe while a second or locking tongue fits into the crease formed between the heel and the upper of the shoe, thus securely fastening the overshoe in place. When it is desired to remove the overshoe it is simply necessary to apply pressure against the heel, which serves to flex the locking tongue out of engagement with the crease.



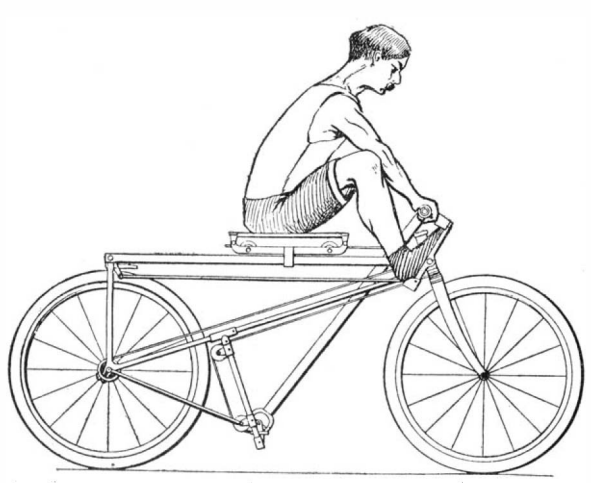
FASTENING DEVICE FOR OVERSHOES.

Trolley Wheel.—New forms of trolley wheel are constantly being patented, showing that the trolley problem has not yet been satisfactorily solved. One of the latest forms is shown herewith. In this construction it will be observed that the trolley wheel is covered by two shields which are independently rotatable on the trolley shaft. These shields are formed with hooked members which overhang the trolley wire and prevent it from slipping off the trolley wheel. The shield pieces are normally held in the position illustrated by two coil springs on the shaft. If, under extraordinary conditions, the wire should leave the trolley, in replacing the wire the shields would move apart against these springs under the pressure of the wire bearing against the curved edges of the hooks.



TROLLEY WHEEL.

Bicycle with Rowing Attachment.—Rowing enthusiasts will find in the bicycle illustrated herewith a very excellent and delightful means of exercising their muscles at times when rowing is unseasonable. The saddle of this bicycle is mounted on trucks which are adapted to run on two horizontal bars of the bicycle frame. The bicycle is driven by a reciprocating movement of the handle bar in a manner simulating that of rowing. A cord connects this handle bar with the rear bicycle wheel which is rotated by the common pawl and spring mechanism. The handle lever is fulcrumed at its lower end in a universal joint. On twisting the handle bar in one or the other direction the front forks are, by means of cord and pulley connection, turned in the corresponding direction, thus affording a means for steering the wheel. Two footrests are provided on the front forks and are so arranged that by pressing down the toes a brake will be set on the rear wheel.

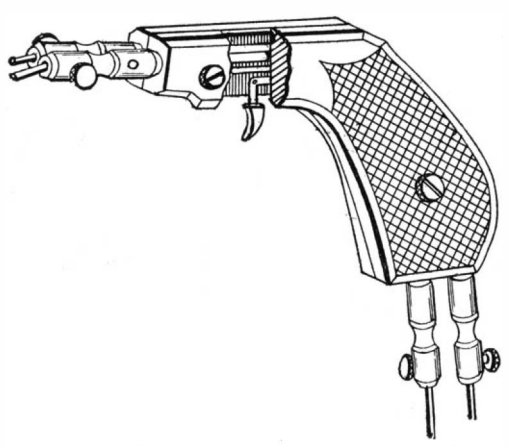


BICYCLE WITH ROWING ATTACHMENT.

Fireman's Suit.—The type of fire which is most dreaded by firemen is that in which volumes of stifling smoke and noxious gases are emitted. To enable firemen to successfully cope with fires of this kind a Colorado inventor has designed a type of garment resembling a diving suit which we illustrate herewith. This garment is composed of gas-tight material which hangs from the helmet and is strapped about the man's waist. The garment is formed with sleeves which are tightly secured at the wrists to prevent entrance of smoke or gases. The air within the garment is kept pure by means of proper chemicals stored in a box on the man's back. A glass-covered opening is placed directly in front of the fireman's eyes, and light is furnished by an electric lamp secured to the outside of the garment. This arrangement enables a fireman to work with impunity in places where otherwise it would be impossible for him to remain on account of the gases and smoke.

SUIT FOR FIREMEN.

Electrical Instrument for Cautery.—We show herewith a simple form of electric switch which will facilitate the use of electricity for cauterizing purposes, particularly in the nostrils, mouth, and throat. This instrument is arranged somewhat in the form of a revolver, so that it can be conveniently held in the hand. The current may be turned on or off at will by pressing the trigger. From our illustration it will be observed that the trigger forms one arm of a bell crank whose other arm, when the trigger is operated, serves to press a contact spring into engagement with the contact plate, thereby closing the circuit to one of the cauterizing wires, the other being normally connected to the battery. The cauterizing wires are held in binding posts and can be readily removed and replaced by wires of different shape and size when desired. The construction and shape of the instrument is such that it will not interfere with the operator's view when performing the cauterizing operation.



ELECTRIC INSTRUMENT FOR CAUTERY.

Brief Notes Concerning Patents.

Thaddeus A. Neeley, of Muncie, Ind., the inventor of the roller skate, expired on December 4 at his home, in the 60th year of his age. He was for many years engaged in the manufacture of the roller skates.

Albert A. Honey, a resident of Chicago, Ill., and the inventor of the underground trolley system bearing his name, died from a stroke of paralysis at the Chicago Union Hospital early in December. He was an old-time telegrapher and was one of the first three operators employed by the Associated Press in that city. He was afterward employed by the Union Pacific and the Northern Pacific roads. Up to a few months before his death he was the president of the Magnetic Equipment Company, but was compelled to resign on account of ill-health.

A hinged trolley harp, the object of which is to facilitate the removal and replacement of the trolley wheel of electric cars, has been invented by Thomas Kelch, the master mechanic of the South Covington & Cincinnati Street Railway Company, and is regularly used on the cars of that company. By removing the cotter at the side, one arm of the hinge may be opened and the wheel slipped from its bearings and another put in its place. The work of changing a wheel can be done in one-fifth the time required with the ordinary harp. It is adapted for use with almost any kind of wheel and there is no space for the wire to get between the harp and the wheel. A copper spring carries the current from the wheel to the pole.

The solar salt industry, which at one time was a great business in Onondaga County, N. Y., has been almost wiped out by the competition from the West, but there are still in operation in New York a few plants where salt is obtained by the solar process. In this industry it is necessary frequently to manipulate the covers of the vats wherein the brine is in the course of evaporation, and as the vats are quite numerous, the services of many man are required for this work. Judge William G. Cady, of Syracuse, has recently invented a method of operating these covers by horse power, so that one animal and a boy can move 160 covers in six minutes. This represents the work of ten men. It is estimated that this device represents a saving of ninety per cent in the labor employed around one of these establishments. It is said that it will be the means of reviving the old industry in this part of the country.

A Manchester printer has devised a machine of wide value to the printing trade. This comprises a cheap, reliable, automatic system for feeding the paper to letterpress printing, lithographic, ruling, and other machines. Hitherto this work has had to be accomplished by hand labor, but by this machine the services of the unskilled hand-feeder are dispensed with altogether. This automatic feeder will do in ten days the same amount of work that takes twelve days to do by hand. The invention is of the most simple construction, having no delicate or complicated working parts to get out of order. It can be adapted to every kind of press, ruling machine, and folding machine, and will feed any size and quality of paper, one sheet at a time, and no more. Should it, however, owing to bad paper, chance to take two sheets or, on the other hand, fail to take a sheet at all, both the feeder and press would instantly stop dead together. It can be put into gear and out of gear in a second, enabling the press to which it is attached to be used for hand-fed runs when required and is unfailingly accurate in its register.

A short time ago the work of demolition of the great Burden water wheel at Troy, N. Y., was commenced, but the action aroused such a great amount of opposition that the work was stopped, and an effort is being made to have the wheel restored and allowed to stand to the memory of Henry Burden, who was its designer and builder, and whose iron mill it operated for many years. The wheel is said to be the largest construction of the kind ever erected and therefore it has a double interest. The wheel is sixty feet in diameter and twenty feet wide. It has thirty-six huge buckets. The journals of the great wheel are 16½ inches in diameter and 18 inches long and it has 264 spokes, each 1½ inches in diameter. The wheel was first put into operation in 1849 and ran almost continuously until 1895, when the works were abandoned. Making two and a half turns per minute, this wheel ran the entire plant, which consisted of one rotary squeezer and muck-bar train, five 9-inch trains for rolling horseshoe and rivet iron, five or six rivet or spike machines, about thirty punching machines, machine shop, roll lathes, shears, and other machinery called for about a rolling mill. At this plant Henry Burden invented and improved a number of processes. The most important and the one for which he is chiefly known is the horseshoe-making machine, which was one of the greatest inventions of the time. Burden also invented the rotary squeezer, which is in use in all mills where iron is made by the puddling process.

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RECENTLY PATENTED INVENTIONS.

Heating.

SMOKE-CONSUMING FURNACE.—J. B. HARRIS, Nashville, Tenn. The invention relates to smoke-consuming furnaces such as shown and described in the prior Letters Patent granted to Mr. Harris. The object of this invention is to provide a furnace arranged to insure a complete combustion of the fuel in the fire-box and combustion-chamber by the introduction of heated air into the front top portion of the fire-box and into the combustion-chamber at the bridge-wall.

Machines and Mechanical Devices.

CENTRIFUGAL MACHINE.—J. H. OSTRANDER, Ticonderoga, N. Y. This machine is designed for use in sulfite, pulp, paper, and chemical fiber mills. The invention relates to improvements in centrifugals particularly adapted for use in pulp or chemical fiber mills for separating liquor from pulp, an object being to provide a centrifugal of simple construction and by means of which the work may be quickly and thoroughly done.

BENDING-MACHINE.—W. VANDERLINDEN, Lansing, Ill. The intention in this case is to provide a hand-machine for bending iron rods or bars to form eyes or angles of any degree in a very simple and effective manner, the machine being durable in construction, easily adjusted for different work, and adapted for hand use on an anvil or other support.

MACHINE FOR STAMPING SOAP, ETC.—L. L. CONWAY, Louisville, Ky. In this patent the improvement relates to an apparatus for stamping a name or device on soap simultaneously or practically simultaneously with the operation of cutting the soap into cakes or bars. The soap may be stamped at any desired interval on the same table and by practically the same apparatus that cuts the soap into bars.

HAT-SHAPING MACHINE.—M. A. CUMING, New York, N. Y. In the present instance the invention relates to improvements in machines for shaping or forming hats of felt, straw, or other fabric, the object claimed by the inventor being the provision of a machine by means of which bell-crown hats may be rapidly and uniformly shaped.

GUIDE FOR SEWING-MACHINE HEMMERS.—H. BLASKOPF, New York, N. Y. Mr. Blaskopf's invention relates to an improved means for guiding and simultaneously curling a piece of fabric as it is drawn into a hemmer or feller so that after the fabric is once inserted into the machine the services of an attendant are not required, the device being to this extent automatic.

MACHINE FOR REPAIRING DRILLS.—J. J. BROSSOIT, Granite, Mont. Briefly stated, this invention comprises means for cutting and shaping the bit of the drill so as to repair any break therein and to sharpen the dulled cutting edges. By means of the apparatus involved these operations may be performed on the drill accurately and quickly by machine-power, and thus a decided advantage over hand-work is attained.

Of Interest to Farmers.

CORN-CUTTER.—T. J. LOVE, Lincoln, Ill. Mr. Love's aim is to provide a construction adapted to operate between two standing rows of corn and provided with means for cutting the corn, for holding it as cut, and constructed to admit the adjustment of the cutting devices out of position for use when it is desired to pass by the shock of corn without cutting the gallas-hill, by which is meant the four hills not cut, but are tied together to set the shock against.

COTTON-CHOPPER. — C. H. WALTERS, Springfield, Mo. In this case the object is to provide a machine that can be driven along a field having rows of cotton-plants or the like and which will have one or more rotary choppers that are rotated from the wheels of the machine and which will effectually sever the plants along the row or rows at or below the surface of the ground either at regular intervals in the rows, leaving the desired number of plants standing, or remove the plants entirely along the row or rows.

Railways and Their Accessories.

RAIL.—L. STEINBERGER, New York, N. Y. Mr. Steinberger's invention relates to improvements in rails, and more particularly to third rails employed for the purpose of distributing electric currents to moving vehicles of various kinds. It relates to several distinct means, and more particularly to certain features whereby the rail is made free to move relatively to its supports.

TRACK STRUCTURE. — L. STEINBERGER, New York, N. Y. This structure is particularly adapted for use for distributing electric current in the capacity of a so-called "third rail." The more special object is to produce a rocker to be applied upon a rail-section, so as to allow the section to rock in a lateral direction and to reduce to a minimum the bearing surface upon the rail rests, lessening the friction of the rail on its supports, and in consequence providing a means for the easy movement of the rail longitudinally and transversely during expansion and contraction of the rails.

Steam Engineering.

STRAINER.—F. G. BROWN, Sheffield, Ala. The object of the present invention is to provide a strainer, more especially designed for use on vertical water-feed pipes for locomotives and other machines and devices and arranged to properly strain the water or other liquid flowing through the feed-pipe and to allow of readily cleaning the strainer of accumulated trash or other impurities. The invention relates to strainers such as shown and described in a former application for Letters Patent of the United States, by this inventor.

Of General Interest.

FOLDABLE CONVEYER.—J. H. TORNEY, Buffalo, N. Y. This conveyer is designed to expedite the handling of freight and reduce the manual labor of handling; to enable the cargo of a vessel to be loaded or unloaded through the upper-deck hatches, thus saving in transporting freight through gangways; to minimize the liability of damage to the freight, particularly frail packages; to compensate for the draft of the vessel during loading and unloading, and to provide for folding the apparatus in compact relation to a warehouse when not in service.

DRILL-CHUCK.—E. R. SMITH, Oneida, N. Y. This invention relates to chucks in which a pair of jaws are mounted to slide toward or from each other on the operator turning a screw-rod having a right and left hand thread in mesh with the jaws. The object is to provide a chuck having a supplementary device for engaging the gripping-jaws to insure an exceedingly strong and firm grip of the jaws on the drill or other tool to be held in the chuck.

GAS-ENGINE COOLER.—C. E. SHAMBAUGH, Lafayette, Indiana. Mr. Shambaugh's invention relates to gas-engine coolers, more definitely stated, improved means whereby increased radiation of heat is effected. The construction comprises radially-disposed plates seated in longitudinally-arranged grooves in the cylinder, the said plates being grooved lengthwise thereof on opposite sides, the ribs between the grooves having series of transverse projections formed by struck-up portions.

BOTTLE-SEAL.—A. R. ROBERTSON, Pass Christian, Miss. To prevent tampering with the contents of a bottle, the device embodies the combination, with the neck which is adapted to receive a cork and formed with two annular beads on its outer surface, of a frangible cap, and a corrugated locking-spring adapted to lie between the beads on the neck and within the cap, so as to contact, thus holding the cap in place. Once seated, the cap can only be removed by breaking it away, and it is purposed forming the cap with an annular weakened portion to facilitate its fracture.

MANUFACTURING ORE BRICKS.—J. KOENIGER, 25 Aachenerstrasse, Cologne, Germany. The process in this invention comprises manufacturing weather-proof bricks for smelting purposes from sandy ores or ore-dust, ore residues, tunnel-dust, burnt iron and copper pyrite residues and from similar material, which consists in mixing materials which are to be submitted to the process in a dry condition with lime, magnesia, and borax and intimately mixing the resultant mass with dilute crude sulfuric acid, then pressing and molding the mixture and drying the resultant bricks. A smelting-brick consisting of ore material, lime, magnesia, borax, and diluted sulfuric acid, is a new article of manufacture.

MANUFACTURE OF DEXTRIN.—G. REYNAUD, 5 Rue Salneuve, Paris, France. Mr. Reynaud's process consists, essentially, in diluting the material to be treated in twice its weight of water and in heating the resultant mass under pressure in a digester at a temperature of 160 deg. to 220 deg. centigrade for an hour and a half. In this heat the cellulose and the amylaceous matters of the peat treated become converted into dextrin or achroodextrin, which is capable of advantageously replacing ordinary dextrin in its industrial applications by reason of its lower density.

BINDER.—J. MONTGOMERY, Fort Worth, Texas. One of the principal objects of the present invention is to provide a device which will securely bind and retain a number of loose leaves, the structure of such a binder enabling it to be readily attached to and removed from the packet of leaves. It appertains particularly to a temporary binder for order-books, cash-books, diaries, etc., capable of being rolled or folded and carried in the pocket.

ELEVATOR.—D. E. CONDON, San Francisco, Cal. The invention relates to spiral elevators as shown and described in the former Letters Patent granted to Mr. Condon. The object is to provide an elevator for use in all classes of modern business buildings in which large crowds of people (and freight, etc.) have to be carried to, from, and between floors in the safest and most expeditious manner, the elevator being arranged for continuous travel of the cars from one floor to another, and enabling the passengers to readily leave or enter cars at any floor.

BEARING FOR ELEVATOR-CARRIAGE ROLLERS.—J. BARRETT, New York, N. Y. The object in view in this instance is to provide a construction which minimizes friction on the engaging surfaces, thus preventing bending and cutting of parts. A further object is to so construct the parts as to produce a strong and light structure, owing to the fact that it is not necessary to cut away the stiles of the elevator-carriage to any material extent in order to mount the rollers thereon.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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Marine Iron Works. Chicago. Catalogue free.

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Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

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The owner of a valuable invention desires to dispose a part interest to a practical man. Address Sanford Weeks. Patchogue, L. I.

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The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

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We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 5355.—For makers of machinery for a milk sterilizing plant.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5356.—For makers of time detectors with 6 keys, also with 12 keys.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5357.—For makers of cutlery or parties doing such job work.

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An inventor who can improve on a small metal article for wearing apparel for ladies and men by a responsible firm. W. A. C.,
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"The Household Sewing Machine Co., Providence, R. I., is prepared to take on contracts for the manufacture of high grade mechanical apparatus, requiring accurate workmanship, in either machine shop, cabinet work, or foundry lines. Expert mechanics, designers and tool makers. Facilities unexcelled. Estimates furnished on application."

Inquiry No. 5359.—For makers of composition billiard and pool balls.

Inquiry No. 5360.—For parties engaged in raising skunks.

Inquiry No. 5361.—For makers of small papier maché articles.

Inquiry No. 5362.—For a new or second-hand small gas balloon, capable of lifting about ten pounds.

Inquiry No. 5363.—For makers of fans, buzz fans operated by water power.

Inquiry No. 5364.—For makers of pleasure launches (gasoline) 17 or 20 feet.

Inquiry No. 5365.—For makers of tin toys.

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Inquiry No. 5367.—For makers of or dealers in siphon pumps.

Inquiry No. 5368.—For a small family ice machine which makes 100 pounds of ice.

Inquiry No. 5369.—For small castings for boat engines and motors, of 2 to 5 h. p.

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Inquiry No. 5372.—For an outfit of archery court.

Inquiry No. 5373.—For makers of small articles suitable for canvassing.

Inquiry No. 5374.—For manufacturers of card embossing and card beveling machines.

Inquiry No. 5375.—For manufacturers of pneumatic goods.

Inquiry No. 5376.—For makers of gas engine castings.

Inquiry No. 5377.—For makers of headless steel hat pins.

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Inquiry No. 5379.—For the maker of a machine for producing quartered figures on plain oak lumber.

Inquiry No. 5380.—For makers of gasoline or hot air engines of about ½ h. p.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Minerals sent for examination should be distinctly marked or labeled.

(9353) A. T. J. says: 1. We say: "The man is *up* in a tree." "The boy is *down* in a well." Does this not mean to say (and is it not really positively correct), "The man is outwardly, in a tree"? "The boy is inwardly, in a well"? I mean there are no such terms as "up" and "down," only as we use the terms to express away from the earth's center and toward it. Am I correct? If "up" and "down" are correct, then to one on the equator at noon the sun would be directly "up" ("above;" and there is no such thing, likewise, as "above") and then at midnight the sun would be "down" ("below;" and there is no such thing, likewise, as "below"); and this would mean to say that the earth passed over and around the sun each 24 hours, or thereabouts. A. The words "up" and "down" refer strictly to the horizon about us, and to nothing else. Up is along a line drawn through the center of the earth and the point on the surface of the earth to which the matter refers. Up and down as you use the words referring to a tree and a well are used correctly. The sun at noon, to a person on the equator, is directly up from the surface of the earth above the head of a man standing at that point, and at midnight the sun is directly down beneath the man's feet. We see nothing wrong in this use of words, nor is the use of them necessary, since other words can be used to express the fact. 2. Is there any proof that the earth travels around the sun as a man would walk around a tree, or that it passes around the sun as a rider "loops-the-loop"? Is not the sun simply "away" from the earth, or the two "separated," without respect to "up" or "down"? A. The earth revolves around the sun in a year; that is, it occupies every point on the plane of its orbit in that time. 3. Can this and similar problems be worked out by any rule? Given a section of a circle, say 13 feet from point to point along the curved line, and the curvature such that a straight line from point to point would measure 10 feet 9¾ inches: required, the diameter of the circle if completed. A. We do not have at hand the solution of the problem concerning the chord and arc of a circle which you request. It can no doubt be solved, but it is not the policy of this paper to devote space to mathematical problems, unless they present some unusual features or are novel. 4. What proof have we that the reason the seas are salty is the emptying of streams into the oceans and seas from inland and no outlet, and not that there are vast salt mines whose uppermost (or outermost) surfaces as washed by the seas' and oceans' bottoms supply the saltiness? A. The proof that the salt of the ocean came from the land is briefly that the land contains large beds of salt, and that bodies of water which have no outlet are salt. There may be beds of salt under the ocean as you suggest, but it is not necessary to suppose them to be there. The saltness of the sea water can be accounted for without this supposition, and if not necessary why make it a part of the hypothesis anyway? No larger suppositions should be made than are necessary in any argument.

(9354) P. S. asks: Will you kindly inform me whether a fish when put into a tub of water will increase the weight of the water as much as the fish weighs or not, and if not, what fraction of the weight of the fish will it increase the weight of the water? A. If a fish is put into a tub containing water, and no water runs over, the weight of the whole is increased as much as the weight of the fish. The water takes the weight of the fish and carries it. The water rests on the bottom of the tub, and the weight of the fish is thus transferred to the bottom of the tub, and the scales, on which the tub may rest. If the tub is brimfull of water, and water overflows as the fish is put in, the weight is not changed by putting the fish into the water. The fish weighs the same as the water it displaces, as may be seen by the fish lying at rest in the water at any depth.

(9355) E. S. L. asks: Why does ice occupy more space than the same amount of water? What is the explanation of globular lightning? Why is the internal resistance of several cells diminished by joining them in parallel? Why is not the E.M.F. increased? A. It is not known why water expands in

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freezing. There are very few substances which do so. Cast iron and type metal are two others which have the same peculiarity, and which are very important to man. The cause of globular lightning is not understood. The resistance of batteries is diminished by connecting them in parallel, because by this mode of connection the battery is reduced to a single cell of size equal to all the cells combined. The current generated by each set of plates is sent out directly into the line, and joins the current of the other plates without passing from cell to cell. The E.M.F. is that of one cell, because there is but one cell. The resistance is that of one cell with plates as large as all the plates combined. The larger the plates, the less the resistance of a cell.

(9356) W. L. G. writes: 1. Will you kindly answer the following question through the columns of your valuable paper? Does the weight of the atmosphere make any difference in the advantage to be derived from a condenser applied to a steam engine? In other words, is the advantage of a condenser greater at the sea level, where the air pressure is about 15 pounds, than it is on a mountain, where the pressure is only 10 pounds? The question does not involve the efficiency of the engine in the different locations, but simply the advantage to be derived from a condenser. A. The efficiency of a condenser is independent of atmospheric conditions, and depends only on the quantity and temperature of the condensing water. 2. Will a non-condensing engine give the same efficiency in a 10-pound atmosphere at 75 pounds boiler pressure as it would in a 15-pound atmosphere at 80 pounds boiler pressure? A. The terminal pressure in a steam engine cylinder is not influenced by differences in atmospheric pressure. Hence the efficiency of the engine depends upon the form of the indicator card alone, save the matter of engine friction, for the actual horse-power. The boiler efficiency may vary slightly with the atmospheric pressure, as water boils under 10 pounds absolute gage pressure, at 193 deg. Fahr. Hence the actual pressure will be greater than indicated by the ordinary gage, and may thus contribute to the apparent engine efficiency.

(9357) F. A. E. asks: 1. Will common wrought-iron pipe 2½ inches in diameter be suitable for a gas or kerosene engine cylinder if machined to suit? I mean, will it stand the pressure at the moment of combustion for a small power engine, and if not would steel tubing (drawn) be suitable? A. The iron pipe if *extra strong* grade will make a fair motor cylinder, but is not as good as steel tubing. It should be *extra strong* to allow for boring out, and amply strong for the explosive pressure. 2. Could you give me a formula for making five pounds of good bookbinder's paste that will keep for an indefinite time, say about one month? A. A good paste to keep may be made by mixing with rye flour paste 10 per cent good thin glue, hot, and then add 15 drops of carbolic acid. 3. Would a steam motor cycle be practical if built compact enough to be portable on two wheels? I think by using a flash boiler and a four-cylinder engine of about 2 inches or 2½ inches, single-acting, with about 2 inches or 2½ inches stroke. A. We do not think a steam motor bicycle practicable. There are too many things to look after and keep your balance; yet there are possibilities in that line. A steam motor bicycle somewhat similar to your idea for one has already been made and is in use in France. A description of it was published recently in the Motor Age.

(9358) H. S. P. asks: Will you kindly give a satisfactory explanation of the well-known fact that small amounts of water aid combustion, for example a forest fire burning green timber, steam injected into a fire-box to increase combustion, or the pouring of water on a great conflagration such as the Baltimore fire? In all of these cases we know or understand that the amount of water present increases the intensity of the fire.

It has been explained that water containing the elements of combustion is decomposed by the heat and the oxygen and hydrogen reunite to produce the hottest flame known. This would be trying to burn the products of combustion and there would be no increase of heat. Others say that the oxygen of the water unites with the carbon to form carbon monoxide and hydrogen, both very combustible with air or oxygen. But in this case the products of combustion are carbon dioxide and water and there is just as much water in the end as in the beginning, per formula:

$$C + H_2O = CO + H_2.$$
$$CO + H_2 + 2O\ (air) = CO_2 + H_2O$$

—it taking as much heat and more to vaporize and decompose the water than is given off when its elements combine.

As steam will not begin to decompose under a temperature of 1,000 deg. C., is it not a question whether any amount of water will actually decompose under such heat as in an ordinary fire-box, or a conflagration? If such was the case, the aid to combustion, by water, would be of a mechanical nature rather than a chemical. What mechanical aid could it possibly give? It seems that small amounts of water would only lower the temperature of the flame by subtracting the heat necessary to vaporize the water. A. We are aware that there is a popular impression that water sprayed into a fire increases the combustion; but we have our doubts as to the correctness of the belief. The doubt you express whether any open fire is hot enough to dissociate water is shared by other chemists. Until it is demonstrated that water can be separated into its constituent gases by an ordinary fire we should consider it very doubtful if water can be an aid to combustion.

(9359) E. H. L. asks: 1. I use water from an irrigation ditch for household purposes, and filter same through a 4-inch wall built of common building brick laid in lime mortar. Will such a filter arrest disease germs, and especially the germs of typhoid fever? A. Filtering the water of an irrigation ditch through a 4-inch brick wall is not reliable for arresting typhoid bacilli. If such are suspected, the water should be boiled after filtering. 2. Two soldiers, using rifles with elevated sights, shoot at a target across a river, say 500 yards distant. A stands at the water's edge, while B stands on a bluff 200 feet higher, but the same distance from target. Should both adjust their gun sights for the same range? A. The rifle fired from the higher elevation should have a slightly lower rear sight than the rifle firing horizontally. The force of gravity is less on an angular trajectory than on a horizontal one; varying as the cosine of the angle from the horizontal range.

(9360) W. J. writes: Will you kindly advise through the columns of the Scientific American what are the reasons given to prove that perpetual motion or any mechanism to develop perpetual motion is an impossibility? Are mechanics and scientists satisfied that such a machine will never be made? A. The most potent of the practical reasons as to why perpetual motion in a mechanical sense cannot be obtained, is derived from the fact that during the past three hundred years the genius of the mechanical world has been directed more or less to the solution of this problem, with many hundred failures and not a single success. Theoretically there is no reason that motion of a body can be sustained without the total elimination of friction and resistance, much less to give out power under any condition, beyond the power originally contributed to start it in motion. The origin of the perpetual motion idea dates back to the dawn of mechanical invention, when in the ignorance and misconception of true mechanical principles, mechanical experimenters, like the alchemists, imbibed the idea of getting something from nothing. Out of these feeble beginnings, a world of truthful facts have had a gradual development in the whole range of mechanical and chemical science, yet perpetual motion and the transmutation of metals are just where they started, three centuries since. Theories are floating conceptions that are only realized by facts, which are truthful and stubborn things.

(9361) H. V. L. writes: Will you kindly answer the following questions through the columns of your paper? 1. In internal combustion motors, what is the ratio of the volume of the gasoline mixture before and after combustion? A. The volume of an explosive mixture of gasoline vapor and air is somewhat less after explosion than the original volume at the same temperature and pressure. The union of the hydrogen in the vapor and the oxygen in the air forms a water vapor, which with the great heat of explosion is largely contributive to the pressure in explosive motors. When the exploded gases cool to normal temperature, the water vapor condenses and so lessens the initial volume. 2. About what is the temperature of the burnt gases at atmospheric pressure? A. The temperature of the exhaust gases at atmospheric pressure varies to a considerable extent by the condition of the primary charge and the explosive temperature; probably 300 deg. F. is an average temperature. 3. What compression is necessary for jump-spark ignition? A. Jump-spark ignition takes place at all compressive pressures, but is more positive with the higher compressions. 4. Will the gases ignite at a lower compression from a hot tube or wire? A. Hot-tube ignition requires compression sufficient to force the charge to the hot part of the tube, generally from 30 pounds and upward. A hot wire will ignite a charge at any pressure. 5. Can you give a formula for computing the safe bearing load of hardened steel balls as used in the caps of ball bearing jacks? A. An approximate safe load for hard steel balls is 20,000 pounds divided by the area of rolling contact in parts of a square inch.

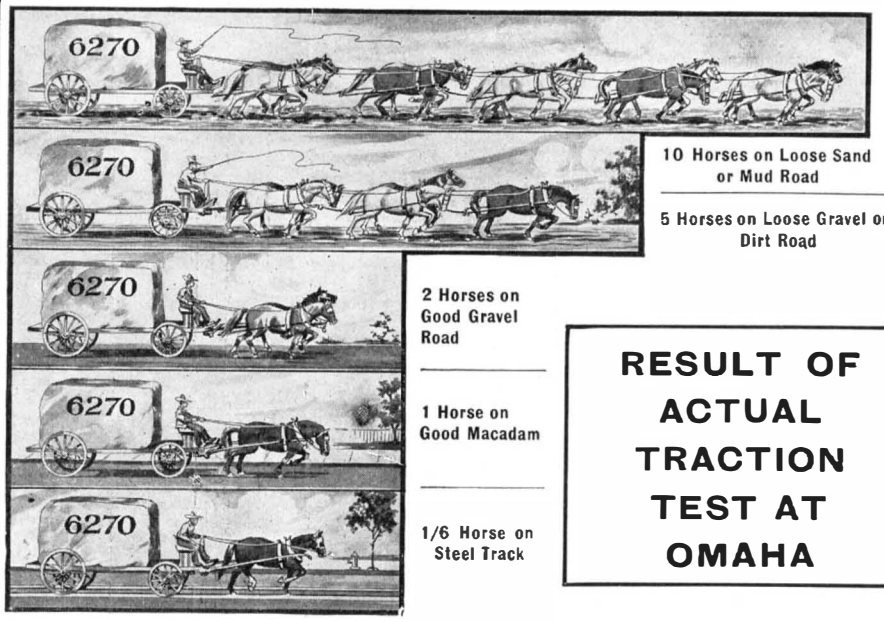
(9362) G. G. G. asks: Please tell us in "Query" column of Scientific American whether the primary purpose of a lightning rod is to prevent a building's being struck by allowing the induced charge to escape from its point, or to quickly ground the current after it has reached the house. While several rods might materially lessen the attraction in the manner above stated, would they be at all adequate to conduct a heavy bolt to the ground? A. The primary purpose of a lightning rod is to act as a conductor for electricity, if the building is struck by lightning. The authorities are not disposed at present to consider that the action of a rod in discharging induced electricity into the air and thus preventing a stroke in the building is important. Too many rods would be required to produce much effect in this way.

(9363) E. M. F. writes: I would be very much pleased if you would answer me in your "Notes and Queries" column of the Scientific American, why it is that the

Good Roads Problem Solved

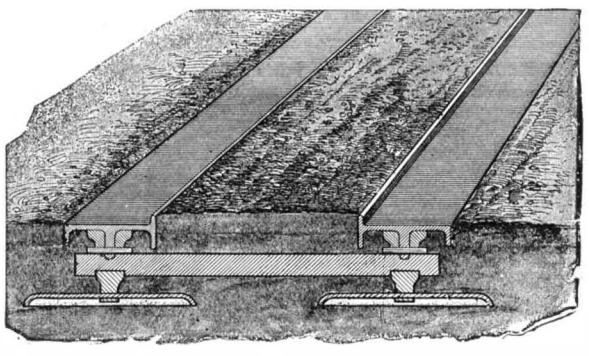
ESSENTIAL TO THE INDUSTRIAL WELFARE OF EVERY COMMUNITY

85%. **It is said, by excellent authority, that fully 85% of the wear and tear on a stone or macadam road is caused by the feet of heavy steel-shod horses.**


6270
10 Horses on Loose Sand or Mud Road
5 Horses on Loose Gravel or Dirt Road
2 Horses on Good Gravel Road
1 Horse on Good Macadam
1/6 Horse on Steel Track
RESULT OF ACTUAL TRACTION TEST AT OMAHA

This illustration is taken from the report of Hon. Henry I Budd, Commissioner of Public Roads, State of New Jersey, 1902, and shows that there is six times more resistance or traction on a stone or macadam road than on a steel track. Reduce this resistance by adopting the steel track method of road construction and the horses can then go smooth-shod or even barefoot without injury to the roadbed or themselves. Less wear and tear on team, wagon and harness. Greater speed and drawing capacity. Needs practically no repairing; therefore less taxes. No mud, no dust. Traveling, either by carriage, automobile or bicycle, made the essence of pleasure.

THE STEEL TRACK HIGHWAY



NO WOOD, NO BOLTS, NO BURRS, 5 METAL PIECES, INTERLOCKING AND INDESTRUCTIBLE

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF PUBLIC ROAD INQUIRIES.
WASHINGTON, D. C., September 11th, 1903.

MR. THOMAS H. GIBBON,
Chief Engineer, Steel Highway Track Construction Co.,

DEAR SIR:—I have just received your letter of August 13th on my return to the office, after a long absence in the Northwest, and have looked through your thesis on steel highway track construction with much interest. For cheapness, simplicity and durability, I have never seen its equal, and have no doubt that you will be very successful in introducing your new steel highway track for general service.

* * * * * * * * * * * * *

Yours truly, MARTIN DODGE, DIRECTOR.

The Steel Track Highway can be placed upon any road at a less cost per mile, upon a twenty-year guarantee, than the best macadam roadbed.

A number of companies are forming to lay Steel Track Highways in each State, and an unusual opportunity is thereby open for progressive parties to secure State rights.

FULL DETAILS AND ESTIMATES ON APPLICATION.

Steel Highway Track Construction Company
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HOME OFFICE
758 Drexel Building, Philadelphia

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sharpest blades are very quickly dulled in cutting cork? A. The elastic nature of cork makes it necessary to *draw cut* in cutting cork, which is not usual in cutting wood. The draw cut tends to dull the edge of sharp cutting tools very quickly when cutting any kind of material.

NEW BOOKS ETC.,

GAS AND OIL ENGINE MANAGEMENT. By M. Powis Bale, M. I. Mech. E., A. M.I.C.E. New York: J. B. Lippincott Company. 1903. Pp. 110. Price $1.50.

The author of this handbook has previously published two similar books for steam engine users, which have been very successful; and, what counts for more, he has had fifteen years' experience with gas engines. The handbook gives a good many practical points regarding the care and operation of stationary gas and oil engines, and it also contains useful tables giving the calorific value of the various fuels ordinarily employed.

L'INDUSTRIA FRIGORIFERA. By Pasquale Ulivi. Milan: Ulrico Hoepli. 1904. 18mo. Pp. 168. Illustrated. Price 40 cents.

This small volume describes in detail the various methods used in producing cold and artificial ice for refrigerating purposes. The liquefaction of air and various gases is also treated quite thoroughly, and the different processes are described. The book also contains sixteen tables of value bearing on the subject treated.

EASY LESSONS IN ARCHITECTURE. By Thomas Mitchell. New York: The Industrial Publication Company. 1904. 12mo. Pp. 92. Numerous illustrations. Price 50 cents.

This little volume is intended to give rudimentary instruction in architecture to all interested in studying that most fascinating art. Each chapter consists of a number of questions and answers on some particular style or branch of architecture from the earliest times down to the present. The arrangement of the text in classified questions and answers puts it in very concise form, and makes the contents of the book easy to grasp and to remember. The present, or second, edition has been especially arranged for American readers. It will be found most useful to all who wish to know something of the main principles of architecture.

MARY OF MAGDALA. An Historical and Romantic Drama in Five Acts. The Original in German Prose by Paul Heyse. The Translation freely adapted and written in English Verse by William Winter. New York: The Macmillan Company. 1903.

We shall not quarrel with Mr. Winter for having done Heyse's religious drama into English blank verse. His rendering undoubtedly gains in dignity thereby. But we do seriously object to his having presented us with an expurgated version, when no expurgation was necessary. Winter's Mary is not Heyse's Mary. The German dramatist painted a strong picture of a woman exultantly sinful at first, bitterly penitent at the last. The American translator robs her of every trait of wickedness, and allows her to weep through four acts, with nothing to weep for. Confessedly ignorant of any knowledge of German, Mr. Winter presumptuously proclaims Heyse's text devoid of poetical or spiritual merit. Those who are blessed with a more intimate acquaintance with Heyse's splendid prose than is Mr. Winter, and who have not based their views on a "rough, literal translation," will find the original a more virile play, with stronger dramatic contrasts, than Mr. Winter would have us believe.

PUBLICATIONS OF THE MISSISSIPPI HISTORICAL SOCIETY. Edited by Franklin L. Riley, Secretary. Vol. VII. Oxford, Miss.: The Mississippi Historical Society. 1903. 8vo. Pp. 531.

The present volume is composed of a number of papers dealing with different phases of State history, and will certainly prove of interest to the historian and to residents of the State of Mississippi. There is an excellent chapter on the Mississippi floods by Dr. John W. Monette, and another chapter is on "The Progress of Navigation and Commerce on the Waters of the Mississippi River and the Great Lakes from 1700 to 1846."

LUFTVERUNREINIGUNG UND VENTILATION. Mit besonderer Rücksicht auf Industrie und Gewerbe. Von Dr. Josef Rambousek. With 48 illustrations and a table. Vienna and Leipzig: A. Hartleben. 1904. 8vo. Pp. 260.

The author starts out with an elementary discussion of ventilation principles, presenting a theory of ventilation and something of the technology of ventilation. In this particular part of the work the chief sources of impurity discussed are the exhalations of the human body. For this reason the earlier divisions of the book are confined to a discussion of the ventilation of dwellings, schools, churches, theatres, and the like. The second division, on the other hand, is devoted to a treatment of the ventilation of industrial buildings, such as factories impregnated with gases and dust. It is here that the author has given striking evidence of original investigation, for which reason these chapters constitute the most valuable portion of this treatise.

DIE PRAXIS UND BETRIEBSKONTROLLE DER SCHWEFELSAEURE-FABRIKATION. Fuer den Chemiker, Meister, Kammerfuehrer, etc. Von Dr. S. Meirzinski. With 19 illustrations. Vienna and Leipzig: A. Hartleben. 1904. 16mo. Pp. 256. Price $1.50.

This work may be considered a practical text-book on the manufacture of sulphuric acid. Under the heading "Chemical Control of Manufacture" only such processes are discussed which are actually in use in laboratories. These processes are so thoroughly and clearly described that even the unpracticed chemist may follow the steps described.

EVAPORATING, CONDENSING, AND COOLING APPARATUS. By E. Hausbrand. Translated by A. C. Wright, M.A., B.Sc. London: Scott, Greenwood & Co. New York: D. Van Nostrand Company. 1903. 8vo. Pp. 400. Price $5 net.

It would be difficult to find a subject where the literature is as inadequate as that relating to evaporating and condensing apparatus, and the author has done a signal service to mechanical engineering in the production of the present book, which is an excellent one. That this book was needed is shown by the fact that the first German edition was exhausted in a very short time. The whole treatment of the subject is most scholarly. We regret that lack of space prevents our publishing at least an abstract of contents.

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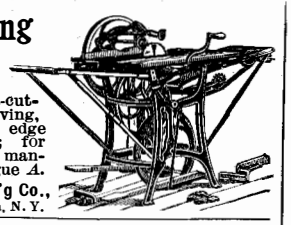

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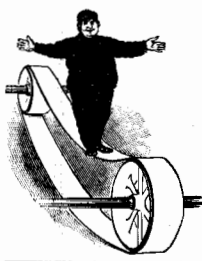

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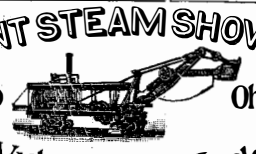

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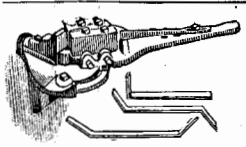

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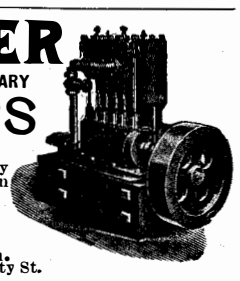

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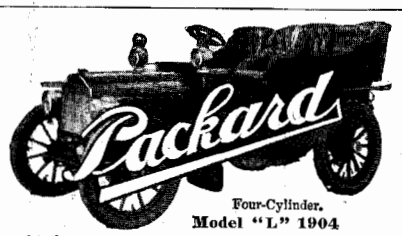

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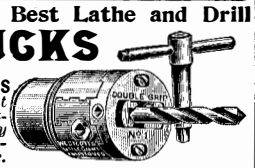

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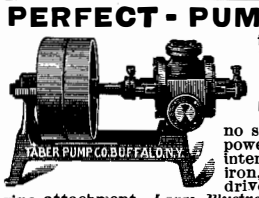

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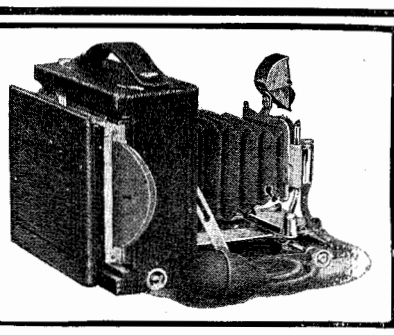

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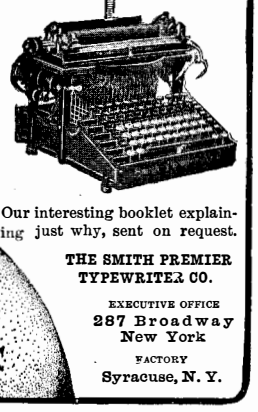

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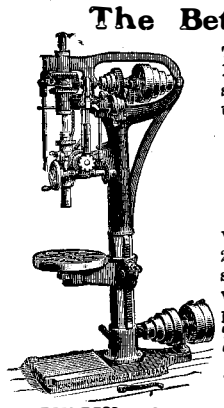

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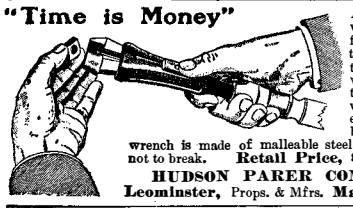

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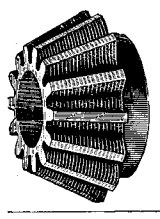

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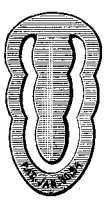

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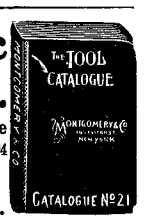

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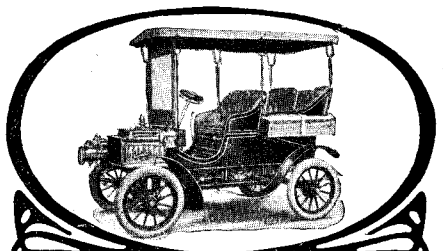

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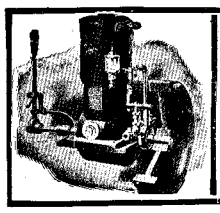

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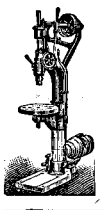

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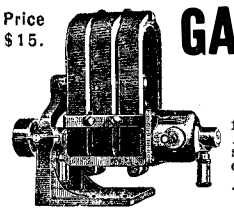

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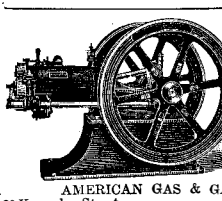

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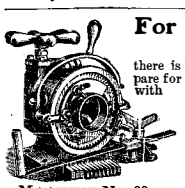

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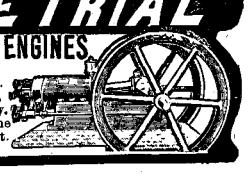

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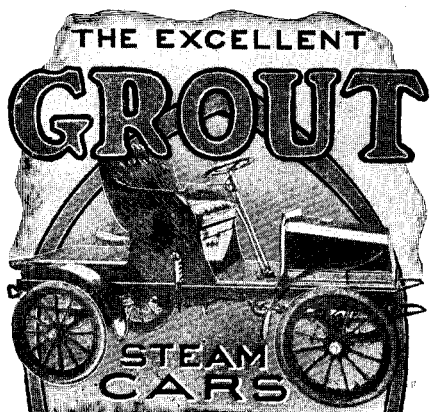

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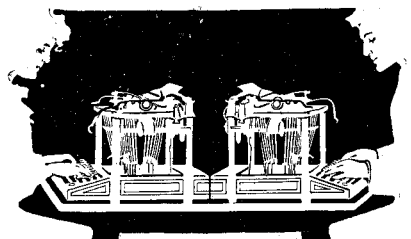

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Multiple rate meter, A. J. R. Fiego	755,757
Music box gramophone attachment, J. L. Schureman, Jr.	755,946
Musical apparatus, pneumatic, F. Schippers	755,944
Musical instrument players, note sheet feed mechanism for, J. D. Smith	756,070
Napping machine, M. La Fountain, Jr	756,029
Nippers, cutting, E. Roraback	756,056
Note sheet guide mechanism, automatic, J. D. Smith	755,950
Numbering machine, E. P. Sheldon	756,063
Nut lock, C. F. Spery	755,806
Nut lock, A. C. Fletcher	756,010
Nut lock, T. L. Russell	756,145
Oil burner, A. Johnson	755,880
Oil burning apparatus, Fraser & Hoyt	755,865
Oil can, F. B. Parker	755,927
Oil mixer and burner, W. S. Kengla	756,116
Ore crushing mill, E. A. Wall	755,725
Ore treating apparatus, T. A. Helm	755,871
Ores, treating, J. Smith	755,951
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Paper pad holder, K. Franklin	756,013
Paring implement, R. M. Babin	755,604
Pasteurizer, W. T. Fogal	756,012
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Peat immediately prior to compression, treating, W. A. Milne	756,129
Peat into blocks for fuel, machine for manufacturing, Kellond & Morrison	755,674
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Pen supporting device, fountain, D. H. Haywood	755,870
Pencil sharpener, E. L. McDivitt	755,917
Phonograph time controlling mechanism, J. E. Hett	756,017
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Photograph machine, P. V. W. Welsh	756,087
Piano touch regulating attachment, Harriss & Kendall	756,016
Pipe coupling, H. Broome	755,994
Pipe coupling, valved, M. T. Quigley	756,053
Pipe supporting bracket, adjustable, A. Clarkson	755,847
Pipe wrench, K. Chickering	755,846
Plant protector, M. B. Lewis	756,123
Planter and marker, G. S. Boyd	756,153
Plow, S. W. J. Stone	755,959
Plow attachment, J. D. Crowe	755,624
Plow, gang, W. L. Cassaday	755,614
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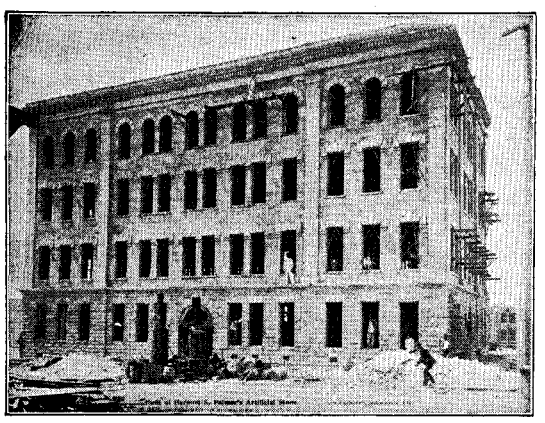

Law Exchange, Jacksonville, Fla., built of Palmer's Hollow Blocks.

WARNING!

Buildings erected with these patented blocks are subject to royalty and Mechanics' Lein, if same is not settled, unless parties erecting buildings have secured their licenses from The Harmon S. Palmer Hollow Concrete Building Block Company or their duly authorized agents.

Machines use Sand and Cement

We Sell Machines, Not Blocks

Blocks From These Machines

give **vertical flues** within that produce the **best ventilation**, retard rain and moisture, and are positive **non-conductors** of heat and cold. These bricks are light, strong and hygienic. No danger of building too high with them. Made in **nine sizes**, from 8 inches upwards, all to fit without any cutting needed. Look like natural stone, last longer, and **can be colored or ornamented** as desired.

These machines for making the above turn out 400 to 600 cubic feet per day in hollow blocks. The blocks are **absolutely fire, water, frost and vermin proof**, and need neither paint nor repairs, require no backing of bricks, and safely carry floors, joists, beams and roofs.

Hollow space affords facilities for gas and water pipes, electric wires, speaking tubes, etc.

Exclusive territory for manufacturing with these machines can be secured by prompt action.

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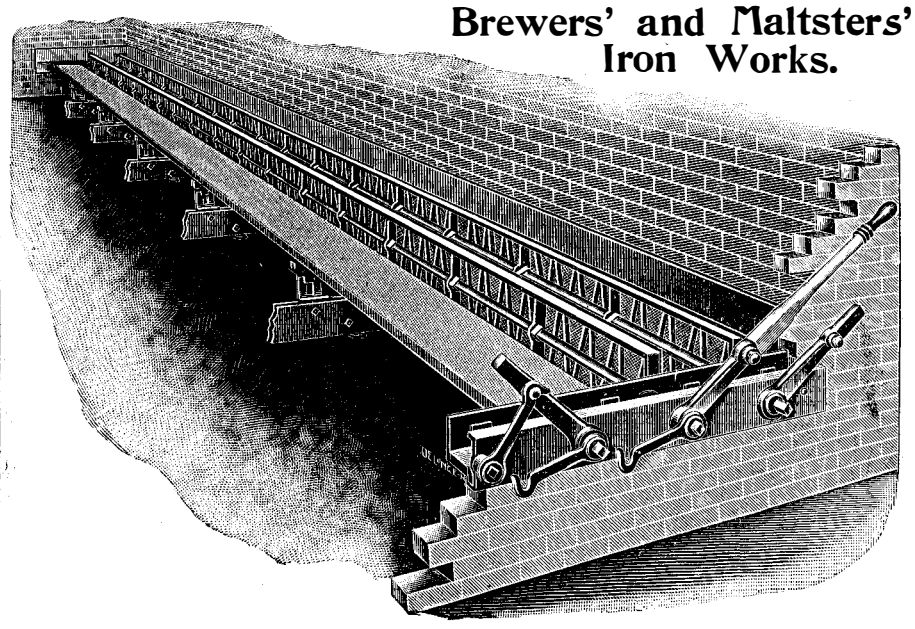

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Over Half Million Square Feet of Our Dumping Kiln Floors Now in Use.

After years of careful study, by men interested in the Malting and Brewing business, the art of malting has been brought to a point where the grain is steeped, grown and dried by machinery requiring but a small amount of skilled labor.

The first mechanical malt turner with the to-and-fro motion, shaft supplied with shovels, was invented and patented in 1871, by Wenzel Toepfer, late senior member of the firm of **W. Toepfer & Sons, Milwaukee, Wis.**, but being too complicated and expensive for the times it was never brought into actual use in the United States.

Great efforts were made to perform the turning of the malt on the kiln floors by means of machinery, however, many experiments in this direction have been made in malt kilns by Mr. Toepfer, to whom the honor is due of having, after many years of expensive experiments, perfected his mechanical malt kiln. That such an apparatus as this has proven to be a blessing, especially to the health of the workingman, is hardly necessary to explain, for everyone with a practical knowledge of malting knows what it means to work at times in a temperature of 40 to 80 degrees Reaumur, in vapor and clouds of dust, besides breathing the sulphur and other poisonous gases of the kiln fire. Moreover, under such conditions, it could not be expected to produce a malt of uniform mellow quality, without flinty and glassy kernels.

The malt house in which the first successful dumping kiln floors were installed was the Pabst Brewing Co. They are still in use after twenty-two years of continual work. Over a half million square feet of these floors are now in use in the United States and foreign countries.

Recently, the **Dumping Kiln Floor** has been improved in several ways by Peter G. Toepfer, sole proprietor of W. TOEPFER & SONS, MILWAUKEE, WIS., U. S. A.

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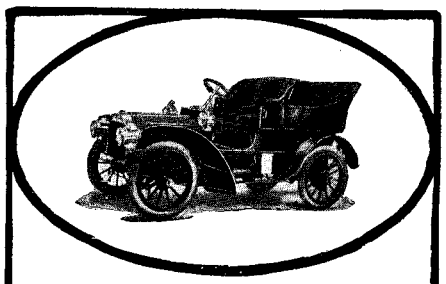

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They are built to give solid comfort and to stand wear without constant attention. Four-cylinder vertical motors, sliding gear transmission, bevel gear drive direct on high speed—forced feed lubrication, long wheel base, cold-roiled pressed steel frame.

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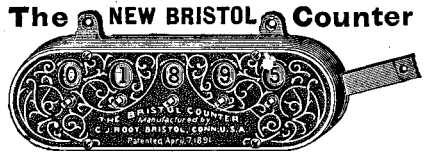

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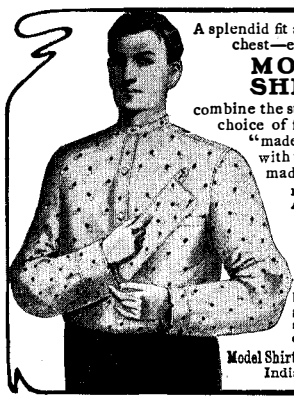

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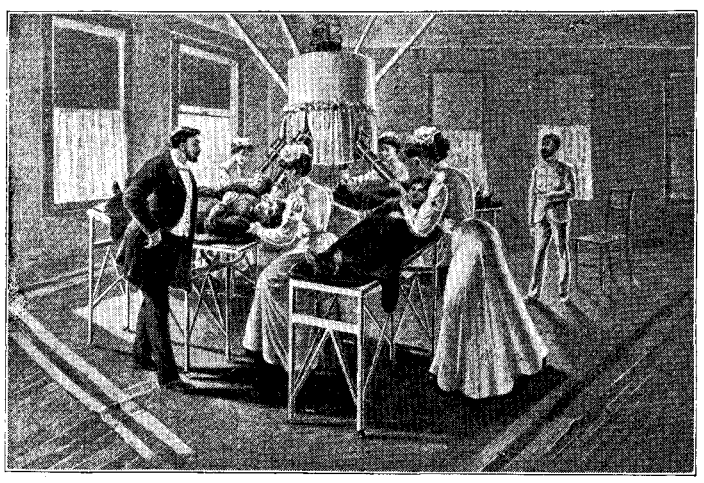

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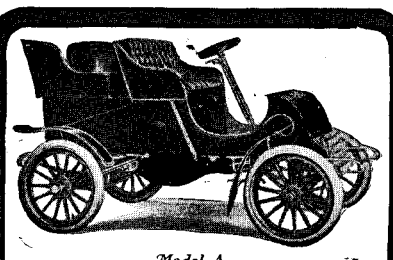

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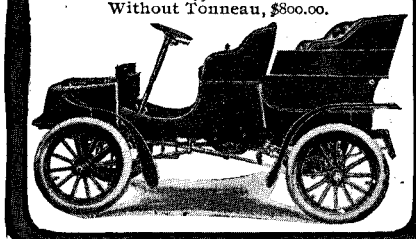

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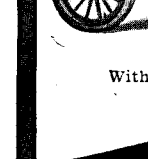

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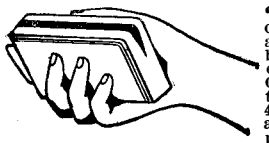

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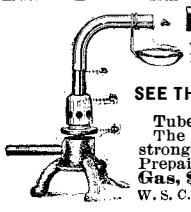

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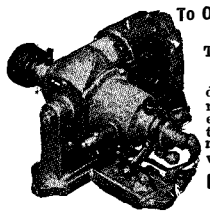

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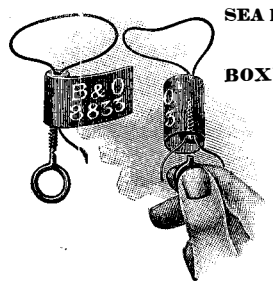

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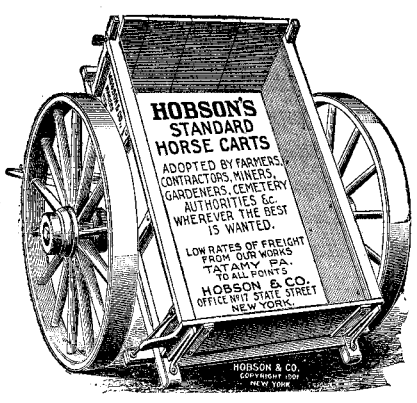
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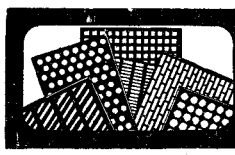

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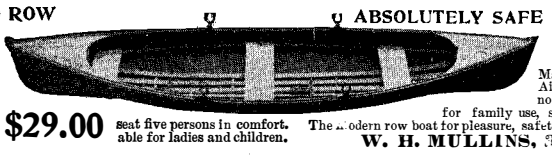

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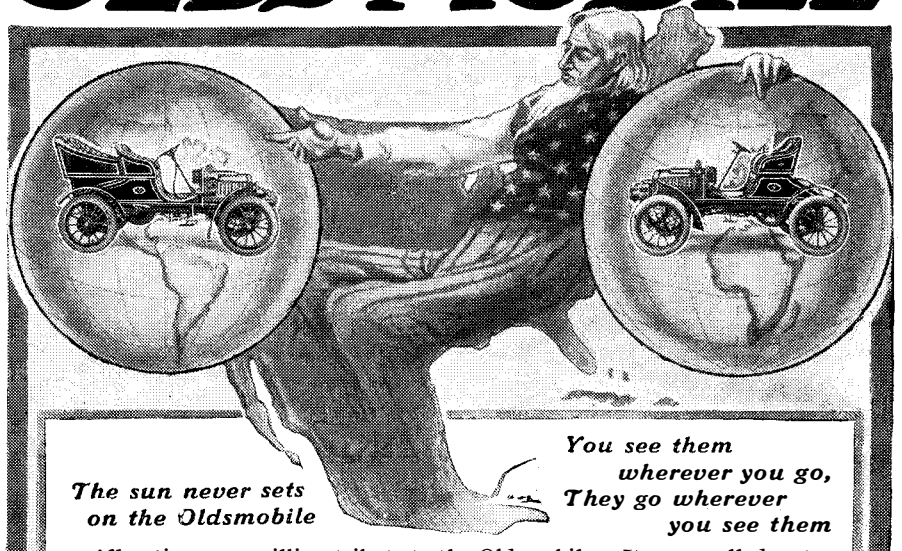

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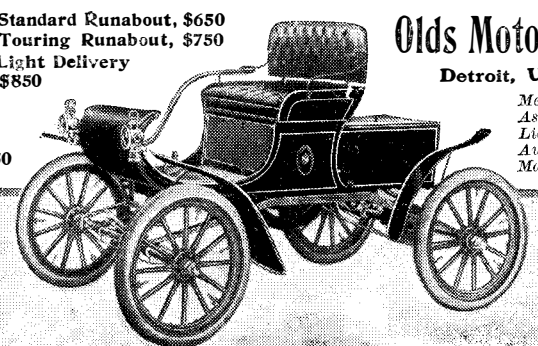

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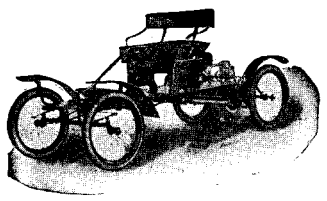

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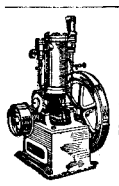

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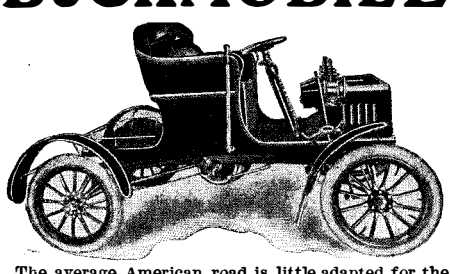

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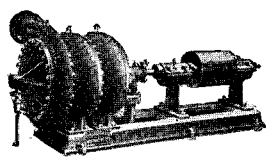

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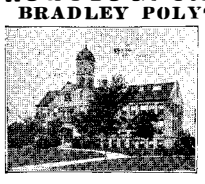

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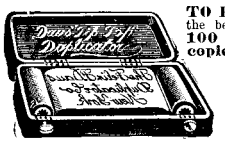

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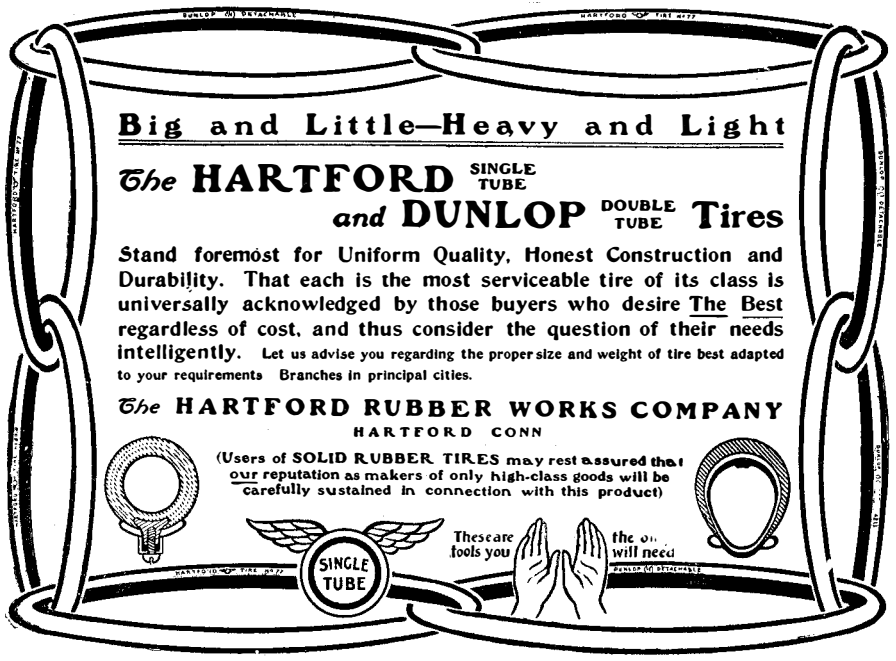
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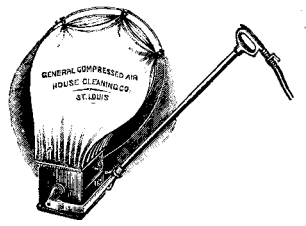

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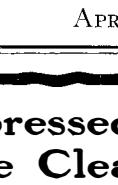

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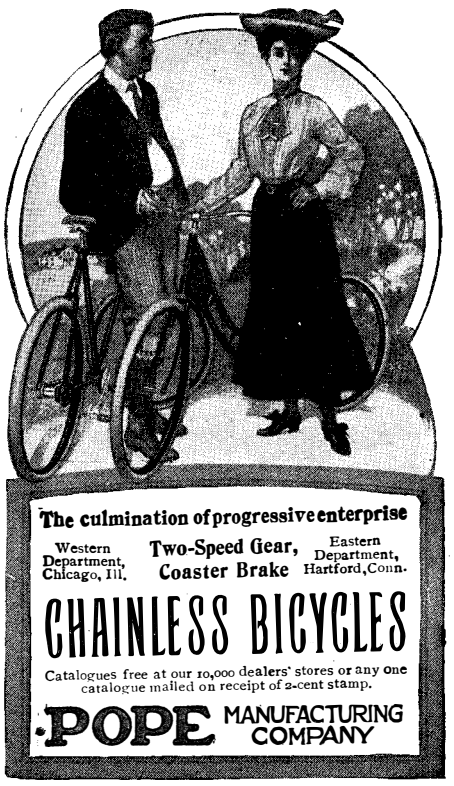

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